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EMISSIONS FROM DIESEL AND STRATIFIED CHARGE POWERED CARS

Karl J. Springer

Southwest Research Institute

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EMISSIONS FROM DIESEL AND STRATIFIED CHARGE POWERED CARS

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16. ABSTRACT

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Tailpipe emissions were measured by the 1975 light duty Federal Test Procedure for gaseous emissions. Smoke and fuel economy were also determined during this test cycle. Odor and related instrumental-chemical measurements were made under seven steady state and three acceleration conditions. Noise measurements were taken by SAE driveby as well as under a variety of exterior-interior conditions. Comparisons of the results for all vehicles are by emission category. The emissions from the group of diesel cars are compared to the conventional gasoline, Ford PROCO, Texaco TCCS, and Honda CVCC.

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Car	Dilution	Emission Controls	
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ABSTRACT

A total of ten passenger cars, four powered by diesel engines, two by stratified charge gasoline engines, one by a stratified charge operating on gasoline and diesel fuel, two by control equipped conventional engines, and one powered by a gas turbine, have been subjected to a wide variety of emissions evaluations. The vehicles, all late model, low mileage, included a Nissan Datsun, a Mercedes 220D, a Peugeot 504D, an Opel Rekord 2100D, a standard Capri, a stratified charge (PROCO) Capri, a low emission prototype Ford LTD, the Texaco TCCS stratified charge powered Cricket operated on gasoline and on diesel fuel, a Honda CVCC stratified charge, and a Chrysler gas turbine car. All were 4-cylinder except the LTD and the gas turbine.

Tailpipe emissions were measured by the 1975 light duty Federal Test Procedure for gaseous emissions. Smoke and fuel economy were also determined during this test cycle. Chassis dynamometer versions of the 1974 heavy duty diesel smoke and gaseous emissions tests were employed. Odor and related instrumental-chemical measurements were made under seven steady state and three acceleration conditions. The Ford LTD and Chrysler turbine car evaluations were limited to odor and related gaseous emissions. The prototype diesel odor analytical system, developed under CRC contract, was applied to the exhaust from both diesel and gasoline engines. Its use as a predictive method of diesel odor was investigated. Noise measurements were taken by SAE driveby as well as under a variety of exterior-interior conditions. Comparisons of the results for all vehicles are by emission category. The emissions from the group of diesel cars are compared to the conventional gasoline, Ford PROCO, Texaco TCCS, and Honda CVCC.

FOREWORD

This project was conducted for the U.S. Environmental Protection Agency by the Department of Emissions Research, Automotive Research Division of Southwest Research Institute. The EPA Project Officer was Mr. Ralph C. Stahman. Assisting the Project Officer on this project and hereby acknowledging their assistance were Mr. Tom C. Austin, Mr. John J. McFadden, Mr. H. Anthony Ashby, and Mr. Donald W. Plungis, all of the Ann Arbor, Michigan EPA laboratories.

The project was under the overall direction of Mr. Karl J. Springer, Director of the Department of Emissions Research who served as Project Manager. Mr. Harry E. Dietzmann was responsible for odor studies with the prototype CRC CAPE-7 DOAS method. Mr. Daniel A. Montalvo assisted in the conduct of the 13-mode HD tests and with the Federal Smoke Test simulations.

The project began in June 1973 and was authorized under Modification 14 to Contract PH 22-68-23. It was known within Southwest Research Institute as Project 11-2340-005.

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ABBREVIATIONS

ADL - A. D. Little
APRAC - Air Pollution Research Advisory Committee
CAPE - Coordinating Air Pollution Engineering
CFM - Cubic Feet per Minute
CL - Chemiluminescense
CRC - Coordinating Research Council
CT - Closed Throttle
CVCC - Compound Vortex Controlled Combustion
CVS - Constant Volume Sampler
DOAS - Diesel Odor Analytical System
FID - Flame Ionization Detector
FTP - Federal Test Procedure
GC - Gas Chromatograph
GLC - Gas Liquid Chromatograph
HD - Heavy Duty
LCA - Liquid Chromatograph Aromatics
LCO - Liquid Chromatograph Oxygenates
LD - Light Duty
LDV - Light Duty Vehicle
NDIR - Non Dispersive Infra Red
PROCO - Programmed Combustion
PT - Part Throttle
Q/I - Quality-Intensity
RVP - Reed Vapor Pressure
TCCS - Texaco Controlled Combustion System
TIA - Total Intensity of Aroma
WOT - Wide Open Throttle

I. SUMMARY

Ten passenger cars, four diesel and three stratified charge, two conventional gasoline, and one gas turbine powered, have been subjected to a variety of emissions evaluations. Gaseous emissions and smoke by both light and heavy duty test procedures, odor, oxygenate, gaseous emissions, and DOAS by transient and steady state procedures, and vehicle noise were the major items of interest. The data was presented and analyzed in each of five major measurement categories. The major findings are summarized as follows.

1. LD Gaseous - The series of 1975 FTP runs with the four diesels, a Nissan-Datsun, Mercedes 220D, Peugeot 504D and an Opel Rekord, illustrated the inherent low emission capability of the diesel powered car. With the exception of the Peugeot 504D,HC and CO were both less than Federal limits for 1977-1978 of 0.25 g/km (0.41 g/mi) and 2.1 g/km (3.4 g/mi) respectively. Two of the stratified charge powered cars, the Ford PROCO and Texaco TCCS (operated on gasoline and diesel fuel), were below the 1978 Federal CO limit, but only the PROCO met 1978 HC limits. HC and CO from the Honda CVCC tested was above the 1977-1978 Federal limit. All cars tested were within the 1977 Federal NO_x limit of 1.3 g/km (2.0 g/mi), but were above the 1978 NO_x level of 0.25 g/km (0.40 g/mi). The range for the four diesels of 0.62 to 0.95 g/km NO_x is about 2.5 to 3.8 times the 1978 limit. It should be noted that the tests were performed on the cars as-received and the results agreed well with earlier tests by EPA.

Fuel economy results by both carbon balance and gravimetric methods verify the range of 10.6 to 12.1 km/litre (24.9 to 28.5 mpg), for the four diesels. The three gasoline fueled stratified charge cars had fuel economy of 10.3 to 11.7 km/litre (24.2 to 27.5 mpg). Measurement of oxygenates (formaldehyde, aliphatic aldehydes, acrolein) and hydrocarbon distribution from bag and trap collected samples was also performed. As HC was lowest for the Mercedes, so were oxygenates and as HC was highest for the Peugeot (of the four diesels tested), so were oxygenates. The oxidation catalyst equipped PROCO produced substantially lower oxygenates than the other cars.

2. HD Gaseous - Replicate tests were made by a chassis version of the 1974 Federal diesel HD 13-mode test. As expected, the CO from all four diesels were substantially below the most stringent level specified by California for 1977. The PROCO and CVCC were substantially higher, by an order of magnitude of the Peugeot 504 CO rate, the highest CO producer of the four diesels. The precious metal monolith catalyst on the PROCO was unable to handle the 75 and 100 percent power points. Combined $HC+NO_2$ for the four diesels ranged from 5.3 to 9.4 g/kw-hr and for the three stratified charge from 9.5 to 12.4 g/kw-hr.

The 1974 Federal standard is 21.4 g/kw-hr (16 g/bhp-hr) and the 1975 and 1977 California standards for HC+NO_x are 13.4 and 6.7 g/kw-hr (10 and 5 g/bhp-hr). HC from the Peugeot was about ten times the other diesel cars. The diesels seemed to react similarly to the LD 1975 FTP and the HD 1974 procedure. The HC and CO from the Peugeot was highest and Mercedes 220D the lowest by both methods.

3. Odor - All cars were subjected to a ten-mode odor test sequence in which each mode was replicated several times in random order on two different days. The trained odor panel, using the EPA Q/I diesel odor kit, rated the samples at the nominal 100:1 dilution level which had been found in the earlier work to be typical for horizontal bumper height exhaust from diesel buses. This 100:1 dilution factor may be low for engines with less exhaust flow than the GM 6V-71 bus engine, such as the diesel and gasoline powered car tested in this study. The dilution ratio is probably high for the gas turbine car with its relatively high exhaust flow. However, lacking definitive field test data on dilution typical of these vehicles, it was decided that a consistent 100:1 dilution level would be run for all the vehicles to provide a common relationship between the odor panel and the raw (undiluted) exhaust.

Mostly mixed behavior in steady state and transient odor levels were observed by the panel. Of the four diesels, the particular Peugeot 504D tested had exhaust odor intensity substantially higher than all other vehicles, about 2 "D" intensity units above the nominal "D" -3.2 of the Mercedes 220D. The diesel fueled Texaco TCCS produced odor equal to that from the Peugeot 504D. When operating on gasoline, the TCCS exhaust was about two-thirds as odorous as when operating on diesel fuel. Transients, more times than not, were the conditions producing the highest odor intensities. For perspective, the "D" odor intensities from the Peugeot were on the order of those measured from city buses equipped with old style "S" injectors.

For the first time, the trained panel was used to evaluate the odor from gasoline powered engines. Extensive pre-test operation and careful selection of test conditions was required to operate each car without production of excessive CO. Gasoline engine exhaust, diluted 100:1, was found to be difficult to rate in terms of the Q/I kit. Especially troublesome were the quality ratings because of the significantly different odor character. The very light ratings found under most conditions with the catalyst-equipped Ford LTD and PROCO Capri and Chrysler gas turbine are questionable, especially as they approach "D"-1. Some values were below "D"-1, which is well below the limit of a panel trained at suprathreshold levels. The Chrysler gas turbine car exhaust odor was very slight except during cold start and to a lesser extent idle operation.

The CRC CAPE-7 DOAS for prediction of diesel odor intensity, an instrumental technique developed by ADL, was found to correlate more or less to the odor panel ratings for the four diesel and some of the gasoline data. This method depends on a suitably trapped and concentrated sample of raw exhaust for which a special interface was developed by SwRI. It was found, for the four diesels, that the observed "D" value was equal to -2 + 3.2 TIA, the TIA being the principal outcome of the odor instrument. Some diesel cars, such as the Nissan and to some extent the Mercedes, exhibited a very close degree of agreement between predicted and observed values. The Peugeot and Opel, however, lacked consistent agreement. Nevertheless, the instrument has the promise of extending the use of the human panel and thereby allow increased research of diesel odor.

One possible use of the DOAS, which is currently limited to trapped samples of extended steady states, is to continuously trap and integrate a sample of the diluted flow during the 1975 FTP. A number of such experiments indicated this approach to have promise. The DOAS, if suitably calibrated and correlated to perceived odor rating, may allow odor prediction under transient operation. Much more work needs to be done in this regard to assess this approach for passenger car odor research. A number of supporting measurements of CO, CO_2, HC, NO_x, O_2, oxygenates, light HC, distribution of HC, etc., were obtained simultaneously with the odor and DOAS measurements.

4. Smoke - Several types of smoke tests were performed. The chassis version of the Federal HD smoke test resulted in smoke from the four diesel cars well below the 1974 limits for truck and bus engines. For the diesel to be considered a viable automobile powerplant, the goal should be an invisible exhaust which is 3 to 4 percent opacity by the EPA diesel smokemeter. The "a" accel and "b" lugdown factors ranged from 3.3 to 5.4 and 2.7 to 7.4 percent opacity, respectively. The Mercedes 220D and Peugeot 504D, both currently in use and marketed in this country, emitted the lowest smoke of the four by this test.

The performance of the four diesel cars on a full power smoke test demonstrated grossly variable smoke output with engine speed. As a result, generalizations about visible smoke from diesels in cars under full load are not possible. The smoke from the four diesel and the three stratified charge powered cars was measured continuously during the 1975 FTP from cold start. Analysis of the strip charts revealed that the same four diesels responded somewhat differently during the transient test. Notably, the Mercedes, which produced low "a" and "b" factors, emitted on the order of 10 percent during the idle periods of the LA-4 driving schedule. The peak opacity during the accels after start was higher than anticipated by the Federal "a" factor.

None of the four diesels could consistently produce exhaust with the extremely low levels of the PROCO and CVCC tested. Some of the diesels showed promise as far as having practically an invisible exhaust.

If smoke opacity is an indicator of exhaust particulate, then the diesel appears to require much more development to match the gasoline car if the test of these specific vehicles is any indicator.

5. Noise - The four diesel and three stratified charge powered cars were found to have varying exterior/interior noise levels depending on test conditions. The measurements continue to demonstrate that diesel cars are not necessarily noisy or noiser than the conventional gasoline powered car used as reference. During the SAE J986a acceleration test, some diesels were higher and some lower than the reference car. Exterior idle measurements indicate engine compartment noise to be definitely higher from the diesel and the TCCS. The diesels were also 3 to 5 dBA higher during driveby runs at 48.3 km/hr (30 mph) cruise. These differences are apparently due to the engine although specific survey data for the various noise sources in each car were not performed.

II. INTRODUCTION

In the search for a low pollution automotive power plant, the diesel has too readily been associated with its sister engine, the spark-ignition engine which operates on gasoline. Most diesels emit far less toxic carbon monoxide (CO) and somewhat less unburned hydrocarbons (HC) than comparable gasoline engines, while oxides of nitrogen (NO_x) have been considered to be about the same overall from both types of engines when compared on the same basis. Although some diesels emit noticeable smoke and/or odor under some operating conditions, both are presently classed as nuisance emissions and not health hazards in themselves.

In the United States, practically all automotive diesels are used in truck and bus applications in intercity and intracity service. Until recently, the Mercedes-Benz, powered by a 4-cylinder naturally aspirated diesel, was the only diesel passenger car in use in this country. Beginning in 1974, the Peugeot 504D offered in a sedan and station wagon was offered for sale. It too is powered by a 4-cylinder diesel of approximately the same power rating as the Mercedes.

A. Background

Emissions studies with the Mercedes 220 diesel were conducted several years ago by SwRI(1)* and then by EPA(2). These results were then summarized in a paper given in 1973(3). Beginning with the 1975 model year, diesel powered light duty vehicles will, for the first time, be subjected to the same standards and procedures as gasoline spark-ignition (SI) Otto cycle powered cars(4).

More and more, the diesel engine is considered a viable alternative to the conventional SI engine for automobiles. Dieselization of a large fraction of the light duty, not to mention the medium duty type vehicles, predominantly gasoline powered, would carry with it a number of advantages and disadvantages. The diesel has a clear superiority over all other power plants in terms of fuel economy and durability. It has demonstrated emissions low enough to meet original 1975 regulations for HC, CO, and NO_x without need of any additional change to the engine(3). The stringent, original, 1976 statutory NO_x limit is currently being reconsidered and it is unknown whether the original Federal limit will be revised upward. Both diesel and gasoline type engines will have a difficult time meeting the original standard.

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* Superscript numbers in parentheses refer to the List of References at the end of this report.

The currently-manufactured diesel has several clear disadvantages over the gasoline engine of particular concern. In addition to poorer power to weight, cold startability, and higher noise than its gasoline counterpart, it has been known for higher emissions of odor, smoke, and particulate. Until more is known of these currently-unregulated emissions, they are classed as nuisance emissions in that they basically interfere with the general welfare. This is not to say they are unimportant.

The Clean Air Act amendments of 1965 were specific in expressing concern over diesel odor and smoke. A long range investigation of diesel odor and smoke began in 1966 by SwRI on behalf of EPA (then NAPCA). This study, currently in its eighth year, has resulted in a number of reports and papers on the subject(5-14). This study of diesel cars is, in fact, Part VI of the long range investigation under PH 22-68-23, the current contract. Several other studies regarding diesel odor and smoke were made by SwRI under separate projects(1-3, 15-19). Particulate from diesel engines has not been well researched. One such study is currently in progress under Contract 68-02-0123 to Research Triangle Laboratories of EPA.

In conclusion, the full potential of diesel powered cars has not been adequately defined although the advantages seem to outweigh the disadvantages. To intelligently judge the diesel and stratified charge powered passenger car, accurate and complete basic data is important. Thus, the justification of the series of tests and evaluations made with several diesel and stratified charge gasoline cars under this project.

B. Objective

The object was to determine and compare emissions from four diesel, three stratified charge, two gasoline, and one gas turbine powered cars. One of the gasoline cars was a catalyst equipped prototype with a conventional engine and the other a standard 1974 model. The cars were furnished EPA through the courtesy of the respective manufacturers. In addition to measuring odor, smoke, and gaseous emissions from the cars using methods adapted from those developed for heavy duty diesel trucks and buses, comparative tests of the gasoline and diesel vehicles were made using the 1975 Federal Test Procedure (FTP) for CO, HC, and NO_x. Noise and fuel economy were also measured using standard, recognized procedures.

C. Acknowledgment

The Environmental Protection Agency selected and furnished the cars for test to SwRI. The cars were provided to EPA for the SwRI test program through the courtesy of the respective manufacturers.

They were Mercedes-Benz of North America, Peugeot, General Motors Corporation, Nissan Motors, Ford Motor Company, Texaco Incorporated, Honda Motors, and Chrysler Corporation. This project could not have been conducted without the cooperation and assistance of these companies, for which we are grateful.

III. DESCRIPTION OF VEHICLES, PROCEDURES, FUELS

This section describes the various elements involved in the wide ranging series of tests and evaluations performed.

A. Test Vehicles

Table 1 lists particulars that describe each of the ten cars involved in this test. All vehicles were delivered to SwRI by car carrier transport.

B. Test Fuels

Table 2 lists pertinent inspection data for the three fuels used in this project. The type 1-D and 2-D fuels conform to the fuel specification given in Reference 20 for diesel emissions (smoke and gaseous) test purposes. The 1-D fuel, a kerosene type diesel fuel, was used with the gas turbine car. There is some concern over the use of this fuel for odor testing and other analysis due to the abnormally high sulfur (intended for durability testing to accelerate corrosion and wear) and the higher than normal aromatics (to accentuate visible smoke emission). For lack of a better or universally accepted fuel, the 1-D and 2-D fuels were used with these reservations.

Also listed on Table 2 are the inspection data for the low lead regular grade gasoline used in the three stratified charge and the two gasoline fueled cars. This fuel was approved earlier by EPA for use in Contract 68-01-0472 on control technology assessment of HD engines. It conforms to the Federally specified unleaded fuel for emissions test purposes per MSPCP Advisory Circular No. 26 "Lead and Phosphorous Content of Unleaded Fuel for Certification Testing"(21). In the test of the Cricket TCCS car, the gasoline was not treated with the base oil additive as agreed with EPA and supplier representatives.

C. Test Plan

Table 3 lists the different tests performed on the ten cars. Practically all tests were performed on the four diesels and three stratified charge cars, while an abbreviated test plan was applied to both conventional gasoline engine and the gas turbine vehicles. Note that the Cricket TCCS vehicle was tested while operating on diesel fuel and while operating on gasoline. All tests were performed in replicate, usually two or more times for best data repeatability and accuracy. The 1975 FTP runs were made on the four diesels as a group. The odor test series was always followed by the 13-mode HD gaseous test. This was the last test performed since it was generally most difficult on the engine. Noise measurements were made in three groups with the standard

TABLE 1. DESCRIPTION OF TEST VEHICLES

	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	Cricket TCCS	Honda CVCC	Chrysler Gas Turbine
Model	220C-QL230	220D	504A20	2100D	LTD	Capri	Capri	TCCS Cricket	Honda	Satellite
Model Year	1973	1972	1973	1973	1973	1973	1973	1972	1975	1974
Car No.	103467	-	-	1810-39	A342-25	2009	2018	RG23916427	SG100698	671
Vehicle ID*	D381	1861	DTM8633	LCJ-150	-	-	XVZ	776-DUZ	ABC	0407
Type of Vehicle	Sedan	Sedan	Sedan	Sedan	Sedan	Sedan	Sedan	Sedan	Sedan	Sedan
Number of Doors	4	4	4	4	4	2	2	4	4	4
Number of Passengers	6	5	5	5	6	4	4	4	4	6
Color	Green	Blue	Maroon	Blue	Green	Orange	Blue	Gold	Brown	White
Odometer, km	8754	13,774	7752	13,023	14,689	2234	1047	5234	7547	5648
Number of Cylinders	4	4	4	4	V8	4	4	4	4	-
Displacement, litre	2.17	2.20	2.11	2.07	6.56	2.0	2.31	2.31	1.56	-
Bore, m x 10^{-2}	8.31	8.71	8.99	8.82	10.2	9.1	7.62	9.8	7.37	-
Stroke, m x 10^{-2}	9.91	9.25	8.31	8.48	10.2	7.7	9.84	7.6	8.64	-
Compression Ratio	22:1	21:1	22.2:1	22:1	8.4:1	8.2:1	11:1	10:1	7.7:1	4:1
Output Power, kw	52.2	48.5	48.5	50.7	128.3	64.2	52.2	44.7	48.5	103.7
at rpm	4000	4200	4500	4300	4000	5400	4000	3000	5500	44,610
Transmission Type	Man	Auto	Man	Auto	Auto	Man	Man	Auto	Man	Auto
Speeds	4	4	4	3	3	4	4	3	4	3
Rear Axle Ratio	3.91	3.92	3.89	3.89	-	3.44	3.44	3.23	4.34	2.76
Tire Size	175SR14	6.95-14	175SR14	645-14	HR78-15	165SR13	165SR13	155SR13	6.00S12-4	HR78-14
Empty Weight (Scale), kg	1415	1356	1266	1243	1955	1012	966	1025	812	-
Test Weight (Inertia), kg	1588	1588	1361	1361	-	-	1134	1134	907	2041

*Per EPA Records.

TABLE 2. INSPECTION DATA FOR DIESEL AND GASOLINE TEST FUELS

Fuel Type Fuel Code	1-D EM-207-F	2-D EM-195-F	Unleaded Gas EM-191-F
Property			
Gravity, °API	43.7	34.5	57.5
Sulfur, % by wt.	0.14	0.3	<0.01
Aromatics, %	12.8	37.6	30
Olefins, %	-	-	3
Distillation, °F			
Initial Boiling Point	349	386	94
End Point	525	658	382
10%	376	436	133
20%	393	461	
30%	406	481	
40%	420	498	
50%	431	514	220
60%	440	530	
70%	450	546	
80%	460	564	
90%	482	605	328
95%	500	648	
Recovery, %	99.0	99.0	
Residue, %	1.0	1.0	
Calculated Cetane No.	53	46.7	
RVP, lbs			8.8
Gum, mg/100 ml			
Unwashed			2
Oxidation Stability			>600
Lead g/gal			0.04*
Phosphorus, g/gal			0.007**
Octane No., Research			92.5
Motor			84

*Determined using Atomic Adsorption Method

**Determined using Dupont Method

TABLE 3. EXPERIMENTAL TEST PLAN

Item of Test	Nissan[1] W	Nissan[1] S	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	Cricket TCCS Gasoline	Cricket TCCS Diesel	Honda CVCC	Chrysler Gas Turbine
1975 LD FTP		X	X	X	X			X	X	X	X	
Alde and Form		X	X	X	X			X	X	X	X	
Acrolein		X	X	X	X			X	X	X	X	
DOAS - Odor		X	X	X	X			X	X	X	X	
Bag & Hot HC		X	X	X	X			X	X	X	X	
Smoke		X	X	X	X			X	X	X	X	
Fuel Economy		X	X	X	X			X	X	X	X	
1974 HD Gaseous (Chassis Version)		X	X	X	X			X	X	X	X	
1974 HD Smoke (Chassis Version)		X	X	X	X							
Odor Evaluation	X	X	X	X	X	X	X	X	X	X	X	X
DOAS - Odor	X	X	X	X	X	X	X	X	X	X	X	
Instrumental	X	X	X	X	X	X	X	X	X	X	X	X
Wet Chemical	X	X	X	X	X	X	X	X	X	X	X	
Vehicle Noise												
SAE Driveby		X	X	X	X		X	X	X	X	X	
Inter-Exter.		X	X	X	X		X	X	X	X	X	

[1] W - Winter Switch; S - Summer Switch

Capri a member of the first two groups for control and comparison. The odor test series was generally run one week per car with a week delay between each car for sample analysis and preparation.

D. Procedures and Analysis

The specific test procedures and analysis systems used for each emissions category are described in the following subsections. In every case possible, recognized procedures published in the Federal regulations were employed. Instruments, sampling and analysis, and other facilities adhered strictly to these methods without exception. Where Federal procedure, or chassis versions of Federal procedures, do not exist, existing procedures for HD diesel vehicles were modified or adapted as necessary for purposes of this project. The advice and consent of the Project Officer was obtained on those areas of substantial modification before proceeding.

1. Light Duty 1975 Federal Test Procedure

The cold start 1975 FTP was the basic gaseous transient procedure used. It is essentially the same for both gasoline and diesel fueled cars. The basic gasoline procedure was described by Reference 20 and modified in more recent Federal Registers. The diesel procedure was adequately described in Reference 4. Hydrocarbon values were obtained by both the bag method, prescribed for gasoline engines, and continuous hot analysis(13). All tests were on the same light duty chassis dynamometer with the same CVS and analytical train. The Federal Test Procedures for gaseous emissions were followed without exception. No evaporative hydrocarbon tests were made.

In addition to the usual HC, CO, and NO_x measurements, samples were continuously taken and collected in reagents for wet chemical analysis, or in suitably packed traps for later odor analysis. These samples were withdrawn in the stainless steel pipe section connecting the exhaust dilution point (below the CVS filter box) and the inlet of the CVS heat exchanger. Multiopening stainless steel probes were used; one probe for the aldehyde-formaldehyde bubblers in series, one for the pair of acrolein bubblers in series, one for each of the three odor trapping systems for the diesel odor analytical system (DOAS).

These probes were located adjacent to the probe used to obtain the continuous HC sample. All sample lines and interfaces were heated as required to maintain sample integrity for diesels. HC sampling and diesel odor analytical systems (DOAS) traps were taken at gas temperatures of 191°C (375°F) and aldehydes, formaldehyde, and acrolein samples were maintained at 71°C (160°F). This is the same temperature used with raw exhaust samples to prevent condensation of water and loss of water soluble oxygenates. Gasoline burning engines were treated somewhat differently. The HC and other continuous lines held at 71°C since gasoline has a lower boiling range and losses are nil at this temperature.

A digital integrator was used to integrate the time-concentration signal from the HC analyzer, a flame ionization detector with linear response. The other continuous samples depended on their absorbing materials, reagent for wet collected samples, and chromosorb in the case of the diesel odor traps to integrate a total representative sample for the entire 1975 FTP. It should be understood that each test included three separate bags for gaseous emissions. The integrator for HC was wired to give three separate integrations.

In the case of wet collected and odor traps, the entire 23-minute (Bags 1 and 2) and the third bag 505-second portion of the 1975 FTP were taken in a single collector (bubbler or trap). This was necessary to obtain sufficient sample for analysis and preclude the problem of switching after the first 505 seconds of the run (cold start bag). For the larger preparative traps collected for use by EPA Research Triangle Park, the same trap was used each run so that generally as many as four complete 1975 FTP runs were collected on one trap.

All runs were made with the CVS main blower slowed to a nominal 5.38m^3 per minute (190 CFM). The reason was to prevent over-dilution of the already air dilute exhaust so as to increase the sensitivity of analysis. No problems were encountered by operating at this lower than normal speed once the CVS was calibrated and propane checked.

A separate series of tests was made for the purpose of measuring smoke continuously with the U.S. PHS smokemeter. This end of stack unit required driving each car over the LA-4 driving schedule but without the CVS connected. During all tests, net fuel consumption was measured by weighing a separate 5 gallon fuel container before and after the initial 23-minute test and before and after the final 505-second run. Care was taken to intercept all fuel return lines to obtain net fuel usage. Fuel inlet temperature was monitored and stayed within specifications. Figure 1 shows various views of the test set-up used with the eight cars tested by the 1975 LD FTP. The driving aid strip chart, engine cooling fan, chassis dynamometer, and variable inertia system are shown in these photos.

Figure 2 (top two photos) shows the arrangement of the items used to continuously monitor or sample the dilute exhaust for oxygenates, HC, and odor. Three ovens housed the systems. Each interface was separate and had its own set of controls, heated sample line or lines. The two center photos show the location and number of heated and insulated

FIGURE 1. CARS UNDER TEST BY 1975 LIGHT DUTY FTP

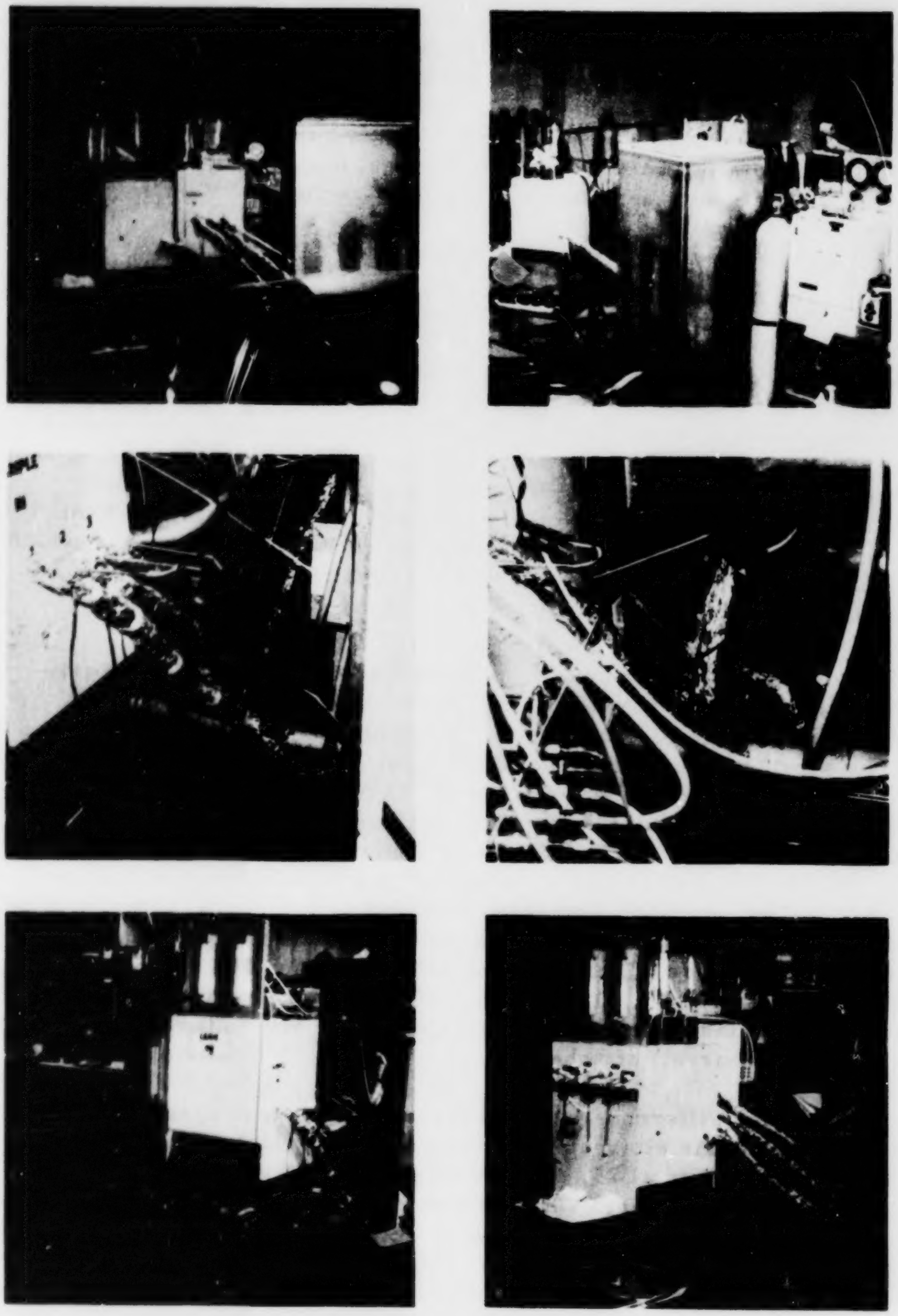

FIGURE 2. SAMPLING INTERFACES FOR HC, OXYGENATES, AND ODOR TRAPS USED WITH 1975 LD FTP

lines and their location between the filter box and inlet to the CVS. The lower left view shows the DOAS trap interface and part of the HC oven relative to the CVS in left background. The lower right view shows the sample interface for oxygenates with the filter box to the right of the oven and the CVS in the background. Additional description of the DOAS and the smoke tests will be given in later paragraphs.

2. 1974 Heavy Duty Gaseous Emissions FTP

The 1974 HD gaseous emissions test, known as the 13-mode test(22), is described in Reference 20 as a stationary engine test. Prior to its adoption by the EPA, an alternative chassis dynamometer procedure had been published by the California Air Resources Board (CARB)(23). The 39-minute long chassis procedure is a speed-load map of 13 modes at 3 minutes per mode. In addition to CO and NO by NDIR (according to SAE recommended practice J-215), air rate must be measured continuously (according to SAE recommended practice J-244). A Flo-Tron system was used to measure the net fuel consumption of the engine, which in turn enabled the use of manufacturers' curves for inlet fuel rate and engine flywheel horsepower to set power points.

The four diesel and one of the stratified charge engines investigated had rated speeds of 4000 to 4500 rpm. One stratified charge engine, the Honda CVCC, had a rated speed of 5500 rpm, while the Texaco TCCS had a rated speed for test of 3000 rpm. For the 13-mode test, the intermediate speed is defined as peak torque or 60 percent of rated, whichever is higher. For this project, all intermediate speeds were computed at 60 percent of rated. The procedure starts with low idle, then 2, 25, 50, 75, and 100 percent load at intermediate speed followed by low idle. Then speed is increased to rated at 100 percent load with decreases to 75, 50, 25, and 2 percent. Another idle is then run. Figure 3 shows the NDIR's for CO and NO and heated FID for HC used during the 13-mode test series. Also shown in Figure 3 are various views of the test cars located on the chassis dynamometer with fuel rate (Flo Tron) and air rate (air barrel) attached.

The major difference between the stationary test used for certification and the chassis alternative is the procedure used to determine the engine operating points at 25, 50, and 75 percent of power and the actual power output at 100 percent. The stationary 13-mode procedure uses measured power output at the flywheel to determine the cycle weighted power for division into the product of emission concentration times density of emission times flow of exhaust to get brake specific emission rate. For engines installed in a chassis, there is no convenient way to measure power output at the flywheel. It is possible to measure the net fuel rate to the engine which can be used to determine power given suitable curves from the manufacturer.

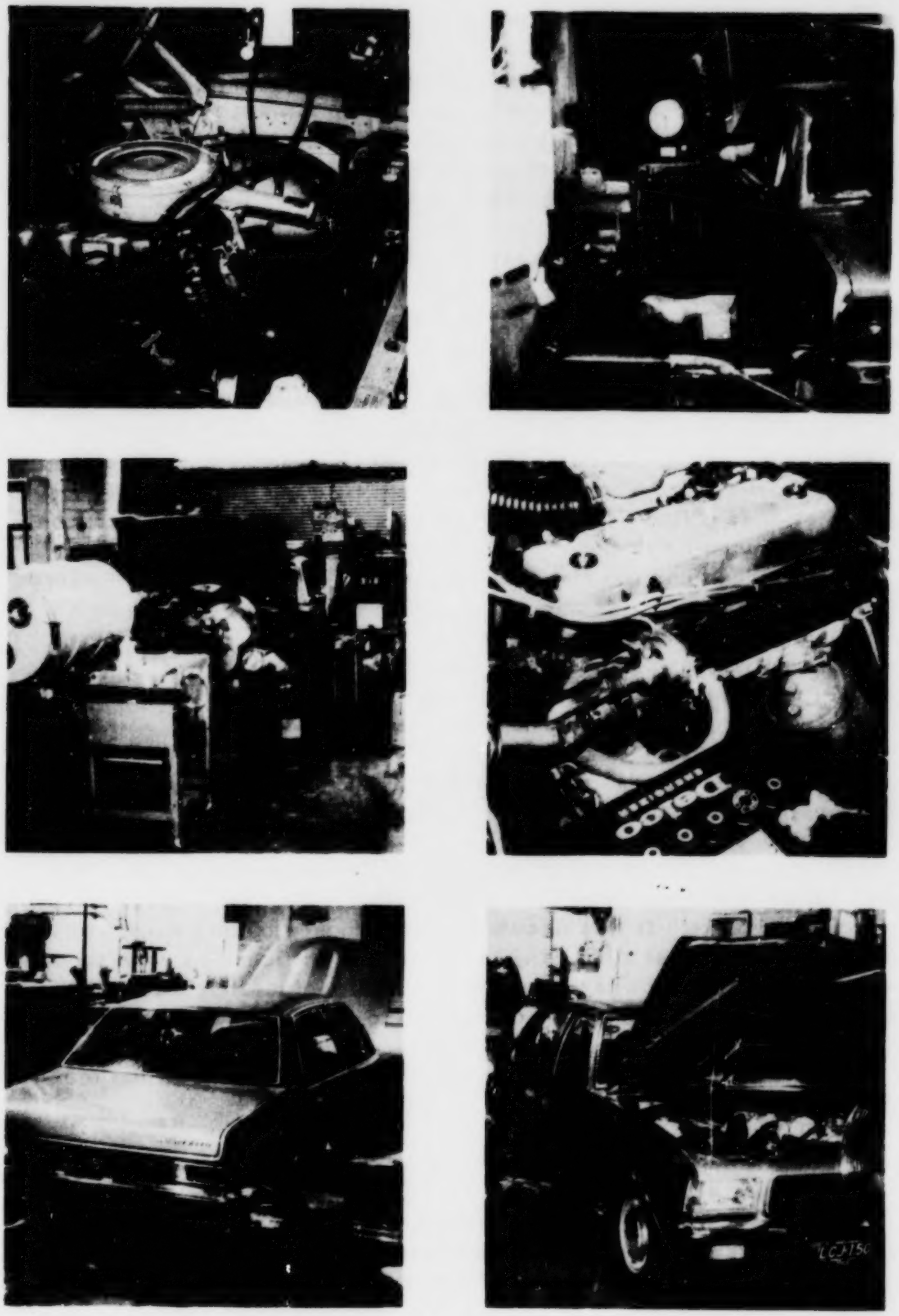

FIGURE 3. DIESEL AND STRATIFIED POWERED CARS UNDER TEST BY CHASSIS ALTERNATIVE OF 13-MODE 1974 HD FTP

For most of the cars subjected to this test, a curve of fuel rate versus flywheel power output, from no load to maximum power output at rated and intermediate speed was available. The procedure was to measure maximum fuel rate by operating at maximum power output at each specified speed. Then, the power output for that fuel rate was read from the curve. The part power fuel rate settings were then obtained from the curve at 75, 50, and 25 percent of the maximum power reading. The vehicle was then operated at these fuel rates during the test and the power used in the calculations was that read or determined by the fuel-power curves.

In some instances, such part load curves were not available, making it necessary to define the maximum flywheel power from full load performance curves which were available. A straight line relationship was then drawn between the full load fuel rate and the no load fuel rate on a plot of fuel flow vs. load for each of the two test speeds. The fuel flow corresponding to the 25, 50, and 75 percent load points were taken from this curve as previously discussed. This practice, required for the Nissan diesel car, assumes fuel rate and power output to be a linear relationship which for most diesel engines, both light and heavy duty, is not too bad an assumption. This assumption was, of necessity, employed in the test of the stratified charge engines.

Of major concern was the choice of engine speeds. Passenger cars are not designed to run the engines normally at rated speed although this is the rule for truck-size or diesel engines in HD use. The rated speed and high load operation, though not necessarily detrimental to these small diesels, is not commonly a condition experienced in urban driving. These concerns were discussed with the Project Officer prior to this series of tests. It was decided, for purposes of this work, to operate the 13-mode test according to the test specifications even though these were determined for larger, lower speed engines. It was felt the results could then be more easily compared to other diesels and to published statutory limits by this test method. Modal emissions data would also be available that otherwise would not be obtained in the test program

3. Odor and Related Instrumental Analyses

This subsection includes evaluation of odor by trained panel, the measurement of gaseous emissions and trapping-analysis of odor samples by the DOAS simultaneously with odor measurements.

a. Evaluation by Trained Panel

The EPA (PHS) quality-intensity (Q/I) or Turk kit method of evaluation of dilute samples of diesel exhaust odor(24) was employed to express odor judgments by the trained ten-person SwRI odor panel. The kit, shown in Figure 4, includes an overall "D" odor in steps of 1 through 12, 12 being strongest, that is made of four sub-odors or qualities. These comprise burnt-smoky "B", oily "O", aromatic "A", and pungent "P" qualities each in a 1 through 4 intensity series, 4 being strongest. Special odor sampling, dilution, and presentation facilities(6, 8) for diesel odor research were developed eight years ago using design criteria obtained in field studies of atmospheric dilution of bus and truck exhaust. Horizontal exhaust at bumper height from a city bus was found to be diluted to a minimum reasonable level of 100:1 before being experienced by an observer. This dilution level was used in the odor test of seven cars, although it is uncertain that this is the reasonable minimum dilution level from a diesel, much less a gas turbine passenger car. References 6 and 8 describe the odor facility and References 6, 7, and 8 describe the development of procedures and operating conditions for research purposes.

Figure 4 shows a number of views of the test set-up used during odor testing. The top left view shows the odor kit and top right, a view of the odor room and panel. The center right view shows the automatic dilution control system and the center left view shows the Model 12A TECO dilution analyzer. The lower left view is of the driver's controls for the dilution and odor measurement signalling while the lower right view shows the relatively small inertia wheel employed during transient operation odor testing.

Both steady state and transient vehicle operation were simulated for odor evaluation. Table 4 lists pertinent operating data for each of the test conditions. The steady state runs were made at three power levels, normally zero, mid, and high power at a high and at an intermediate speed. The seventh condition was a low idle of a well-warmed-up engine. For the four diesels, mid load was defined as a fuel rate midway between the fuels rates at full and no load (transmission in neutral). These seven conditions were performed in random order so as to replicate each condition three times for a total of 21 runs. To the extent practical, cold start odor ratings were taken with all cars. A hot start and a deceleration-relight were employed with the gas turbine along with the conditions already mentioned.

The odor measurement procedures applied to the diesel powered cars was in keeping with that used in 1971(1, 3) and was based on the extensive previous work with diesel exhaust odor measurement from larger size vehicles. One important change was made from 1971, however, and that was to operate the cars more nearly as they might on the road. This meant changing the engine speeds from rated and intermediate, as defined for the 13-mode test, to lower speeds.

In accord with the Project Officer, high speed was defined as the engine rpm corresponding to 90.1 km/hr (56 mph) level road load.

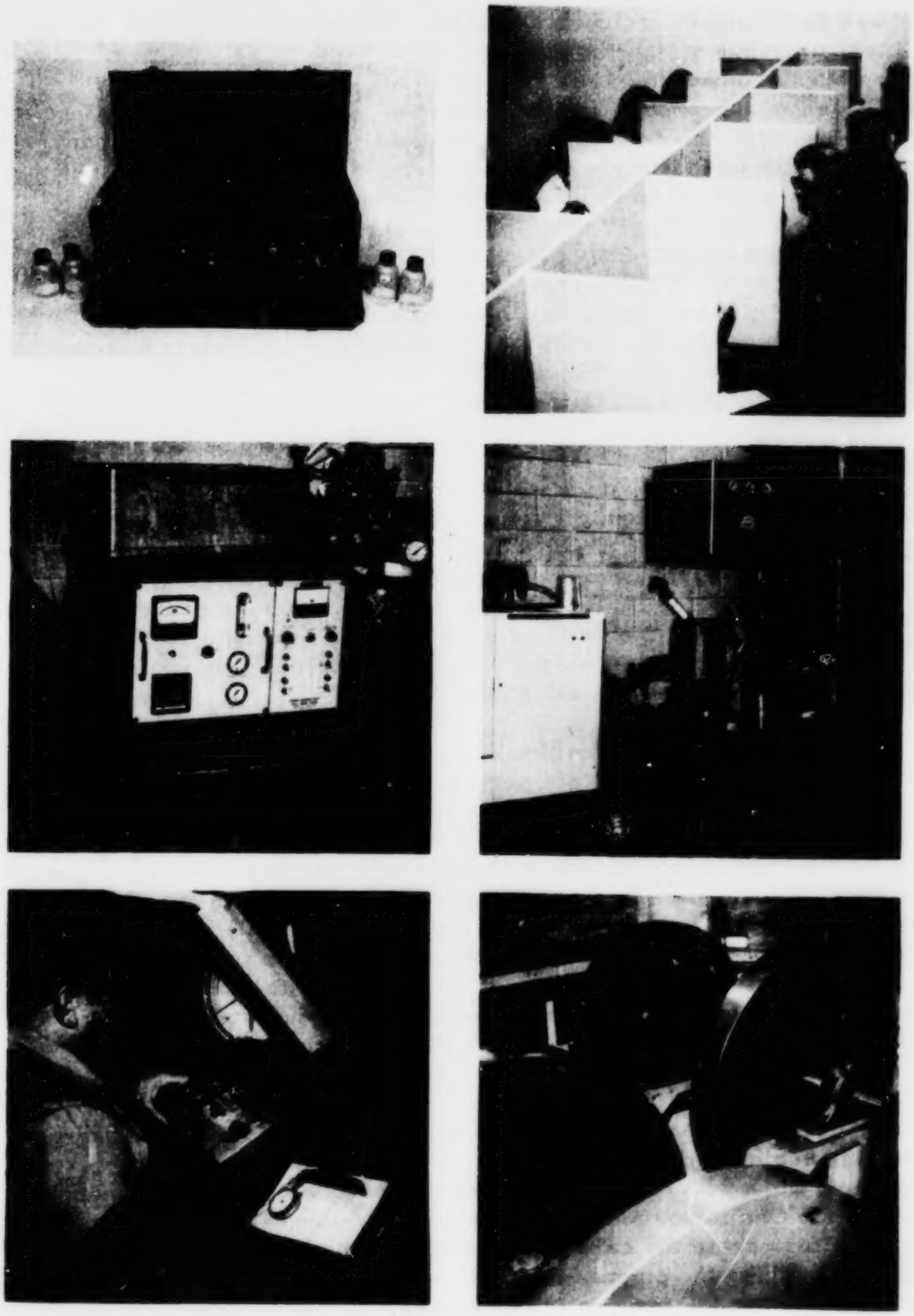

FIGURE 4. ODOR MEASUREMENT BY TRAINED SwRI PANEL USING EPA Q/I RATING SYSTEM

TABLE 4. PASSENGER CAR ODOR TEST OPERATING CONDITIONS

	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	Cricket TCCS		Honda CVCC	Chrysler Gas Turbine
								Diesel	Gasoline		
Steady State Operation											
Engine High Speed, rpm	3800	3050	3000	3250	2000	2850	2850	3000	3000	3800	2120(1)
Engine Inter Speed, rpm	1800	1830	1800	1950	1200	1700	1700	1800	1800	2300	1272(1)
Fuel Rate High, high speed (kg/hr)	11.2	9.7	10.9	12.0	23.8	9.1	10.7	10.2	9.7	7.0	24.9
inter speed	6.3	5.4	5.9	8.8	5.4	3.5	4.2	3.4	2.9	3.1	9.8
Mid, high speed	7.0	6.4	6.9	7.5	11.8	6.1	7.6	6.1	5.9	4.8	14.7
inter speed	3.9	3.4	3.6	5.1	4.8	2.5	3.4	2.7	2.2	2.1	7.8
No, high speed	2.9	2.9	2.9	3.0	5.7	3.0	4.3	2.9	2.9	2.3	7.4(2)
inter speed	1.5	1.5	1.4	1.4	3.6	1.8	2.0	1.5	1.3	1.3	4.9(3)
Drive Gear, high speed	3rd	D-4	4th	D-3	D-3	4th	4th	D-3	D-3	4th	D-3
inter speed	3rd	D-4	4th	D-2	D-3	4th	4th	D-3	D-3	4th	D-3
Vehicle km/hr at high speed	64.4	90.1	90.1	90.1	90.1	90.1	90.1	90.1	90.1	90.1	90.1
inter speed	38.6	53.1	51.5	35.4	49.9	53.1	54.7	53.1	53.1	54.2	53.1
Engine Idle Speed, rpm	1200	800	750	600	900	800	900	900	900	1200	-
Transient Conditions											
Idle-accel km/hr start	0	0	0	0	0	0	0	0	0	0	0
end	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Driven in	1st	D-1	1st	D-1	D-1	1st	1st	D-1	D-1	1st	D-1
Odor Test rpm	3900	3160	2930	2100	1200	2800	2700	1950	1950	2850	1345(1)
km/hr	32.3	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1
Accel time, sec	5	3.5	3.5	3.5	4	4.5	4.5	3	3.2	4	4.5
Accel range, km/hr, start	38.6	48.2	40.2	56.3	32.2	48.3	48.3	48.3	48.3	48.3	40.2
end	80.5	80.5	72.4	88.5	80.5	80.5	80.5	88.5	88.5	80.5	88.5
Driven in	3rd	D-4	3rd	D-3	D-3	4th	4th	D-3	D-3	4th	D-3
Odor Test rpm	3450	2460	2950	3000	1480	2250	2250	2700	2700	2900	1865(1)
km/hr	72.4	56.3	64.4	80.5	72.4	72.4	72.4	80.5	80.5	72.4	80.5
Accel time, sec	16	13.5	7.5	12	7	9.7	8	10	12	12	6
Decel range, km/hr, start	80.5	80.5	80.5	88.5	72.4	80.5	80.5	80.5	80.5	72.4	80.5
end	32.2	48.3	40.2	56.3	48.3	56.3	56.3	48.3	48.3	48.3	56.3
Driven in	3rd	D-4	3rd	D-3	D-3	4th	4th	D-3	D-3	4th	D-3
Odor Test rpm	3000	1930	2600	2400	1200	2000	2000	1900	1900	2200	1575(1)
km/hr	40.2	56.3	56.3	64.4	56.3	64.4	64.4	56.3	56.3	56.3	67.6
Decel Time, sec	12	13.5	8.5	13	13.5	15	10	13	13.2	16	7

(1) Power Turbine Speed into transmission.

(2) No load run in D-3, 2120 rpm, no neutral in transmission.

(3) No load run in D-1, 1415 rpm, no neutral in transmission.

(4) Decel-Relight same as Decel, except odor test is 2 sec after relight, 66 km/hr, 22,000 rpm gas generator.

In practice, the level road load, defined for a specific car test weight (given in the Federal Register(20)) was set in the dynamometer (80.5 km/hr (50 mph) and then the car increased in speed to 90.1 km/hr (56 mph). Most of the cars were, in high gear or high range of the transmission, operating at approximately 3000 engine rpm at 90.1 km/hr (56 mph). The intermediate speed was then defined as 60 percent of this speed, which was a nominal 1800 rpm for most cars.

In the afternoons, an acceleration after upshift, a deceleration after a cruise, and an acceleration after idle, from rest, were run. These three transients were replicated in random order four times, for a total of twelve transients per afternoon.

An available 1769 kg (3900 lb) inertia wheel was used to simulate the inertia of all vehicles except the Cricket TCCS and Honda CVCC. This wheel was larger than desired for all the cars except the Ford LTD and Chrysler gas turbine. It had the effect of prolonging accelerations which was good from the standpoint of being able to stress the car and allow time for odor measurement consistent with the heavy duty vehicles tested in the past. The next smallest available inertia wheel of 1361 kg (3000 lb) was used with the Cricket and Honda, which was also larger than the test weight, but satisfactory for purposes of odor measurement.

The accel after prolonged 1 minute idle normally involved evaluation during a rapid wide open throttle (WOT) acceleration in low gear. The odor was evaluated at nominally 24.1 km/hr (15 mph), 1200-3000 rpm which was reached 3.5 to 5 seconds after start of the accel. The accel was generally made in high gear after upshift and began at about 32.2 km/hr (20 mph) after start of accel. The accel ranged in time from 7 to 16 sec depending on car performance. The decel was from 80.5 to 88.5 km/hr (50-55 mph) to 40.2 to 56.3 km/hr (25 to 35 mph) with evaluation at 56.3 - 64.4 km/hr (35 to 40 mph) about 8.5 to 15 seconds after closed throttle (CT). In all transients, the LD FTP road load was preset in the water brake dynamometer at 80.5 km/hr (50 mph)

Operation of the three stratified charge and two control equipped conventional cars posed some special problems in that they were the first gasoline powered vehicles evaluated by the trained SwRI odor panel. The carbon monoxide in most gasoline engine exhaust, relative to that from diesels, is substantially greater and requires special pre-evaluation examination of the test procedure and dilute test levels of CO by staff of the Emissions Research Department and the SwRI Committee on Protection of Human Subjects.

For example, the Ford LTD, a 1975 prototype, highly controlled, car equipped with dual monolith type oxidation catalysts and air pump produced, under some operating conditions, an excessive amount of CO, even when diluted to the nominal 100:1 for panel observation. Beckman NDIR (315B) CO analyzers were used to continuously monitor the diluted exhaust presented to the panel. All conditions were found to produce less than 50 ppm CO (diluted) except the accel transient. Discussions with the Committee on Protection of Human Subjects, prior to odor evaluations, were formalized by a memo dated April 10, 1974, that indicated the condition, the accel, to produce an average (of several trials) CO of 411 ppm.

It should be noted that the current Occupational Safety and Health Administration (OSHA) limit is 50 ppm CO per eight hour working day. There is no concern about CO levels at or below this level in the dilute exhaust. For very brief exposures and a minimal number of occurrences in a given working day, the range of 400 to 500 ppm CO in air (one-hour or less exposure) has been considered the limit. Beyond this, the experiment takes on other meaning and requires a different approach.

The selection of the test conditions has a lot to do with the specific CO encountered. And, just because CO is low by the light duty 1975 FTP does not mean all conditions of operation are low. Therefore, the selection of conditions can influence the difficulty of evaluation. In the case of the Ford LTD, the vehicle was substantially overpowered compared to diesel cars, trucks and buses, i.e., power to weight was much greater. The conventional steady state map of two speeds and three loads used with **the** diesel cars (0, 50, and 100 percent power) had to be reconsidered. After some preliminary testing, discussions with the Project Officer were held to establish a test condition protocol more consistent with the gasoline and gas turbine powered cars.

It was agreed to operate at 90.1 km/hr (56 mph) in high gear, i.e., 4th in the manual transmission Capri and Honda and in D-3 of the Ford LTD, Texaco TCCS and Chrysler gas turbine, and call the engine speed that coincides to 90.1 km/hr (56 mph) the high speed as with the diesels. As an example, for the Ford LTD, this was a nominal 2000 rpm. The other speed was then 60 percent of 2000 or 1200 rpm. The car speed, still in D-3, was 50.5 to 54.7 km/hr (31.5 to 34 mph), depending on transmission slip. The loads were the most difficult to select since max power was dramatically greater than road load of 9.5 kw (12.7 hp) for the 2041 kg (4500-lb) car at 80.5 km/hr (50 mph) per Federal Register.

For lack of a better approach, it was decided to run at four times road load, if possible, and call this the high power condition. The procedure was to preset a dyno load of four times road load - dyno loss into the water brake at 80.5 km/hr (50 mph) and then increase speed to 90.1 km/hr (56 mph) and record the resulting manifold vacuum, fuel rate, and rear wheel power level. In the case of the Ford LTD, this was

48.8 kw (65.5 hp), 23.8 kg/hr (52.5 lbs/hr) fuel and 127mm (5 inches) vacuum. It produced an unacceptable CO level due to apparently "being in power valve". In accord with guidelines given by the Project Officer, the condition was modified to a 178mm (7 inch) 38.8 kw (52 hp) condition that brought CO back into control with less than 50 ppm dilute. Apparently, from other measurements of O_2 and HC, a CO "breakthrough" occurred as operation progressed toward WOT.

The intermediate speed high power condition was based on the present four times road load at 80.5 km/hr (50 mph), but operating at 1200 rpm to give 49.9 km/hr (31 mph), 10.8 kw (14.5 hp) rear wheels, and 5.44 kg/hr (12 lbs/hr) fuel rate. The no load conditions were like that for diesels, namely, operation in neutral at the 1200 and 2000 rpm (Ford LTD). The intermediate power setting was not like the high power condition but from two times road load at 80.5 km/hr (50 mph) and then increased to 90.1 km/hr (56 mph) at 2000 rpm and then decreased to 1200 rpm.

The basic philosophy was to characterize odor over a range of loads and speeds that could be encountered and over a wide enough range to cover steep uphill plus moderate trailer towing as well as the moderate load and no load conditions.

Two of the three transients were quite difficult to run in the same way as diesel powered and lower power to weight vehicles. The Ford LTD had substantial power and therefore a WOT 0 to 32.2 km/hr (0-20 mph) idle-accel was out of the question. As a substitute, an idle-accel of the LA-4 driving schedule, starting at about 450 seconds of the trace, was used. This is the most severe accel from rest noted in the entire schedule, yet was no problem for the Ford LTD. CO was also acceptable with exposure at 24.1 km/hr (15 mph).

The decel also had no problem in CO for the Ford LTD by CT from 72.4 to 48.3 km/hr (45 to 30 mph) with evaluation at 56.3 km/hr (35 mph). The Ford LTD produced an average of 411 ppm CO (dilute) during the part throttle accel from 32.2 to 80.5 km/hr (20 to 50 mph) with evaluation at 72.4 km/hr (45 mph). Again, a WOT accel, normal for diesel odor testing, was not acceptable, this time from excessive CO and the violent downshift, high rate of accel uncommon to road operation with this vehicle. To permit a repeatable part throttle accel that could be considered stringent, yet typical, the accel rate established by the idle-accel transient, using the LA-4 trace was employed. This particular accel stops short of 80.5 km/hr (50 mph) and therefore the linear accel rate was merely extrapolated to 80.5 km/hr (50 mph) by using a straight line. The actual vehicle operation included a PT crowd of the accelerator pedal to maintain a constant rate of accel. This approach was found to be quite repeatable and the operator merely kept using the same piece of chart paper, a copy of which is shown in Figure 5.

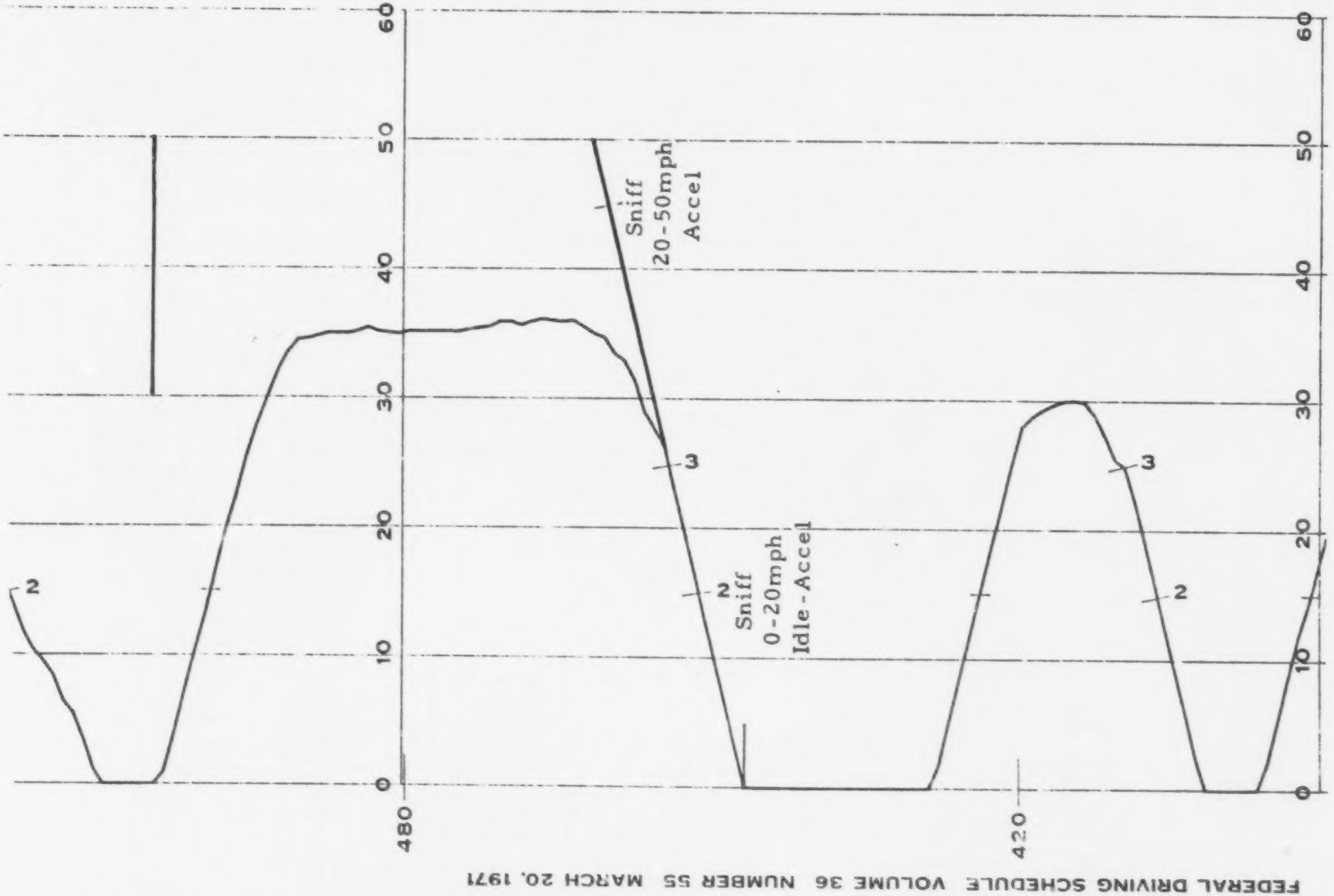

FIGURE 5. PORTION OF LA-4 DRIVING TRACE (1975 FTP) USED FOR IDLE-ACCEL AND ACCEL ODOR EVALUATION OF SELECTED CARS

The standard Capri four-cylinder Ford passenger car followed the same test condition guidelines as the LTD. The CO from this less well controlled vehicle required more attention with more conditions producing higher than desired diluted CO. They were:

Condition	Diluted CO, Avg.
no load idle at 800 rpm	191 ppm
90.1 km/hr (56 mph 2800 rpm 4th gear 29.8 kw (40 hp)	89 ppm
PT accel 102 mm (4 inches vac) 48.3 - 80.5 km/hr (30-50 mph) sniff at 72.4 km/hr (45 mph), road load	148 ppm

Operation of this car at WOT during the accel caused excessive CO to be produced. Therefore, a part throttle crowd type accel maintaining 102mm (4 inches) intake manifold vacuum was used. The idle-accel was run similar to the LTD. The LA-4 test inertia for the two Capris was taken at 1134 kg (2500 lbs). This was equivalent to the weight of the car, 966 kg (2130 lbs) measured by certified public scales + 136 kg (300 lbs) and rounded up to 1134 kg (2500 lbs). This test weight was discussed with Mr. Don Plungis of EPA who concurred in the 1134 kg (2500 lbs) instead of the 1247 kg (2750 lbs) used in 1974 certification. A memo dated April 16, 1974, to the SwRI Committee on Protection of Human Subjects, described these test conditions and CO levels in detail.

The decel at CT was of great concern in that at 508+mm (20+ inches) vac, the CO was higher than desired. By decelerating at very light part throttle 495mm (19.5 inches) constant, the CO was drastically reduced. The driver operated the foot feed in reverse of a "crowd" and was successful in holding a constant decel vac.

Fewer conditions exhibiting excessive CO were encountered with the Ford PROCO stratified charge powered Capri since it was highly controlled and featured an oxidation catalyst mounted just after the exhaust manifold. Nevertheless, a full check-out was made with practice runs prior to odor panel evaluation. The only condition of some concern was found to be cold start, which was run only once and the accel after idle. The idle-accel was run per the Federal Register LA-4 driving trace shown in Figure 5. Since the dilute CO was still less than 50 ppm, no modification was made to the procedure.

The accel and decel transients were made at WOT and CT, respectively, with no CO levels over 50 ppm measured in the diluted stream. Using the four times road load at the two speeds did not produce excessive CO or CO breakthrough as did occur during the 13-

mode testing. The four times road load represented less than wide open throttle where excessive levels of CO would have been produced.

Operating conditions for the Texaco TCCS powered Cricket are listed on Table 4. The top two photographs in Figure 6 are the Plymouth Cricket powered by the Texaco TCCS engine under test. Whether operated on diesel or gasoline, the basic engine speeds of 3000 and 1800 rpm were the same as were transmission range, acceleration, and deceleration conditions. The fuel rates, in kg/hr were higher for the diesel fueled operation since the density of diesel fuel is 0.851 kg/l (7.098 lbs/gal) versus 0.747 kg/l (6.233 lbs/gal). The conditions of Table 4 were arrived at after trial and error as with the Ford LTD and Capri standard and PROCO powered cars.

The steady states were based on operating at 3 times the 80 km/hr (50 mph) road load prescribed by the Federal Register of 7 kw (9.4 hp). The car was then accelerated to 90.1 km/hr (56 mph) at which point the engine rpm was measured at 3000 rpm which was the high power high speed condition. The car was then slowed to 53.1 km/hr (33 mph) for 1800 rpm engine speed with the same road load. This became the low speed high power point. The mid-power points were similarly set using 1.5 times the road load. No load conditions were run with the transmission in neutral.

Transients were performed with a 1361 kg (3000 lb) inertia wheel and road load preset in the dynamometer at 80.4 km/hr (50 mph) All accels were made at wide open throttle and all decels were made at closed throttle between the speeds listed in Table 4. During the steady state modes, the bell for odor panel operation was 1.5 minutes after going to the condition with about 1 minute of steady state operation just prior to the bell. The transients were always preceded by 30 seconds of a given operation such as idle prior to the idle accel, cruise at 48.3 km/hr (30 mph) prior to the accel or cruise at 80.5 km/hr (50 mph) prior to the decel. The cold start condition was made from an overnight soak at 74°F with merely engine start followed by the cold idle. The bell for panel evaluation was rung as the engine started. CO from both gasoline and diesel fueled TCCS engine was found to be at or below 50 ppm in the pre-runs of the diluted exhaust for odor measurement. Both the stratified charge and the oxidation catalyst combine to prevent excessive CO levels that would preclude odor measurement by the panel.

The Honda CVCC, also shown in the center two photos of Figure 6, presented some different problems in that CO was substantial at high load settings. However, by operating this car at 3 times road load and monitoring CO production, it was found that this vehicle could also be tested by the odor panel with CO well within acceptable levels. Note from Table 4 the higher engine speeds employed with the CVCC engine. The seven steady state conditions were in keeping with the other stratified charge cars, the PROCO and TCCS.

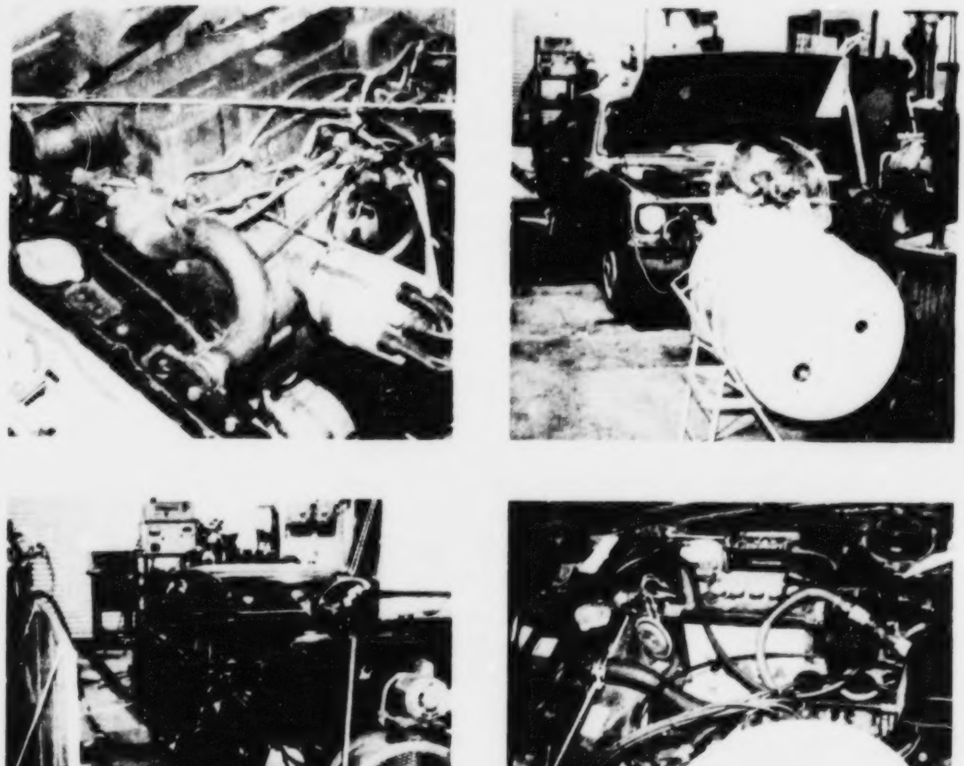

FIGURE 6. STRATIFIED CHARGE AND GAS TURBINE POWERED CARS PREPARED FOR ODOR TESTING

Transients were similar to other cars with the exception of the idle-acceleration which had to be driven at part-throttle in first gear. This accel to 32.2 km/hr (20 mph) was made using the driving chart in Figure 5. Cold start tests did generate fairly high CO levels but when diluted 100:1 were below 100 ppm. The Honda front wheel drive car required the use of a slightly longer than usual exhaust pipe connection to the odor system. Otherwise, its operation was not grossly different from other cars tested in this project.

The Chrysler gas turbine powered Plymouth Satellite, shown in the lower two photos of Figure 6, entailed some special preparations and pre-test experimentation to permit odor panel measurement. The first special preparation involved obtaining a suitable sample of the vehicle exhaust for odor and gaseous emissions measurement. The gas turbine engine features twin exhaust ducts, rectangular in cross section that are fitted beneath the floor pan of the vehicle. The ducts terminate at a point forward of the rear axle assembly. This means the large volume of exhaust from the engine comes from under the car rather than at the rear bumper. A matched pair of exhaust pipes were fabricated which extended into the open duct 0.4 m (16 inches). These 63.5mm (2 1/2 inch) outside diameter exhaust probes were manifolded by means of long radius elbows into a common 127mm (5 inch) exhaust pipe which led to the odor dilution system and gaseous emissions sampling location.

The two probes depended on the raw velocity of the turbine exhaust to force the sample over to the dilution system where a smaller sample is withdrawn for dilution and evaluation. It was found that this system worked quite well. It necessitated keeping the laboratory high bay doors open and the use of several large fans to expel the remaining exhaust from the vehicle, a substantial flow. Response of the system was not quite as rapid as the conventional closed system with time of the exhaust to reach the dilution point increased by perhaps up to 1 second at idle and much less at all other conditions. Provision was made to shield the hot exhaust from the underside of the fuel tank.

By connecting the conventional Flo-Tron directly to the fuel lines at the tank, the net fuel rate into the engine could be measured much the same as with other engines with return fuel such as diesels. The gas turbine car was unlike most other cars in that the transmission had no neutral gear. This meant all no load conditions were actually run with the car in gear, rear wheels rotating, but with no power absorption in the water brake dynamometer. Another important difference is the gas generator speed substantially higher and indirectly related to power turbine speed. Since a standard three-speed automatic transmission is employed and it is coupled directly to the power turbine shaft, the power turbine speed was the speed used to set operating conditions. The power turbine speed was essentially that which would be provided by a conventional engine to the transmission.

With these introductory remarks regarding the Chrysler gas turbine car, the usual ten operating conditions, seven steady state and three transients, were determined. They are summarized on Table 4. The power turbine speeds are quite consistent with the Ford LTD. As with the Ford LTD, the Chrysler gas turbine had a high power to weight ratio and had excellent performance in terms of acceleration. To set load points, four times and two times road load at 80.5 km/hr (50 mph) were used instead of 3 and 1.5 for the lower power to weight TCCS, PROCO, and CVCC powered vehicles.

The 0-32.2 km/hr idle-accel, due to the acceleration performance, had to be run at part throttle using the driving aid chart in Figure 5. For the cold start, the bell was rung for the panel when the starting sequence light on the dash went out. The gas turbine engine has an automatic start sequence with cold start time to light of about 15 seconds. When the light goes out, the vehicle may be driven.

Two additional conditions were evaluated which included a hot start, made like a cold start except with the engine fully warmed-up, and a deceleration-relight. The gas turbine burner fuel is automatically shut-off during all closed throttle decelerations. The gas turbine automatically relights when the gas generator speed reaches about 22,000 rpm. Thus, the normal deceleration condition was timed to be just prior to the relight rpm at 23000 rpm and the relight condition 2 seconds after the reignition of the burner. These additional conditions of decel-relight, cold and hot start made the gas turbine total conditions equal 13.

Under no conditions did the gas turbine engine produce CO of concern from a panel health standpoint. This is not surprising since the gas turbine is a low CO emission engine and has substantial excess air which serves to dilute the exhaust. Given an additional 100:1 dilution for panel observation results in CO of negligible concentration.

b. Gaseous Emissions

Gaseous emissions were also taken during these steady-state, speed-load odor maps. Measurements included HC by heated FID, CO, NO and CO_2 by NDIR, NO and NO_x by chemiluminescence (CL), O_2 by polarographic method, acrolein, aliphatic aldehydes, and formaldehyde. The chromotropic acid method for formaldehyde, 3-methyl-2-benzothiazolone hydrazone (MBTH) method for aliphatic aldehydes, and the 4-hexylresorcinal method for acrolein, all of which are wet chemical methods, were employed. These are described somewhat in Reference 7.

The seven conditions, in triplicate (21 runs) were repeated on two mornings normally separated by one day for analysis and preparation.

These measurements were intended to define the steady state performance and characterize emissions beyond that possible from the 1975 LD FTP and the 1974 HD FTP 13-mode test. Also, the data would be useful in comparison with and correlation to the odor panel ratings and other measurements by the CAPE-7 DOAS instrument. Figure 7 shows a number of photos of the gaseous emissions instruments, equipment, and analytical equipment utilized in this category of tests.

The classification of exhaust hydrocarbons by different molecular weight categories was a requirement of this project. All such analyses require a sample of concentrated exhaust for analysis by gas liquid chromatograph (GLC). The type column (length and packing) has been essentially standardized to the use of a 3.05m x 3.18mm (10 ft x 1/8 inch) 5 percent Dexil 300 on 60/80 AW/DMCS Chromosorb G columns in which the sample is eluted by a carrier gas, nitrogen, while the column temperature is slowly raised, temperature programmed from 100°C to 350°C at 10°C/min after 5 minutes of isothermal operation at 100°C.

No common or agreed upon method for concentrating the diesel exhaust hydrocarbons has been universally accepted. Initially, it was planned to concentrate the exhaust in a "U" tube cold trap of 203.2 x 3.18mm (8 x 1/8 inch) stainless steel held at -40°C. This method had been used in the past with mostly satisfactory results.

With the use of the Chromosorb 102 packing to collect hydrocarbons and other odorous materials in the exhaust for later odor analysis by the CRC APRAC CAPE 7 liquid chromatograph, developed by A. D. Little, Inc., another, more convenient concentration-collection method was available. The ADL diesel odor analysis system (DOAS) is described in the next subsection and requires a non-aqueous, concentrated sample of organic exhaust products for analysis. Chromosorb 102 will absorb oxygenates and unburned fuel at slightly elevated temperatures, permitting the water vapor to pass through the column. The trap can be capped off and is reported reasonably stable for several days. During this time, the absorbed organic matter can be extracted by eluting with a pre-purified solvent, cyclohexane. A small amount of this extract is then used in the DOAS and a small amount of the remainder is injected into the Varian Model 1740 GC used for hydrocarbon analysis.

The resulting chromatogram is then analyzed for peak height, area and elution time. These values are then compared to calibration standards from which a quantitative and qualitative indication of hydrocarbon distribution may be determined. The only change to usual laboratory practice for these measurements was the use of the DOAS sample. This is considered to have definite advantages in sample integrity and potential future use in evaluating the DOAS results.

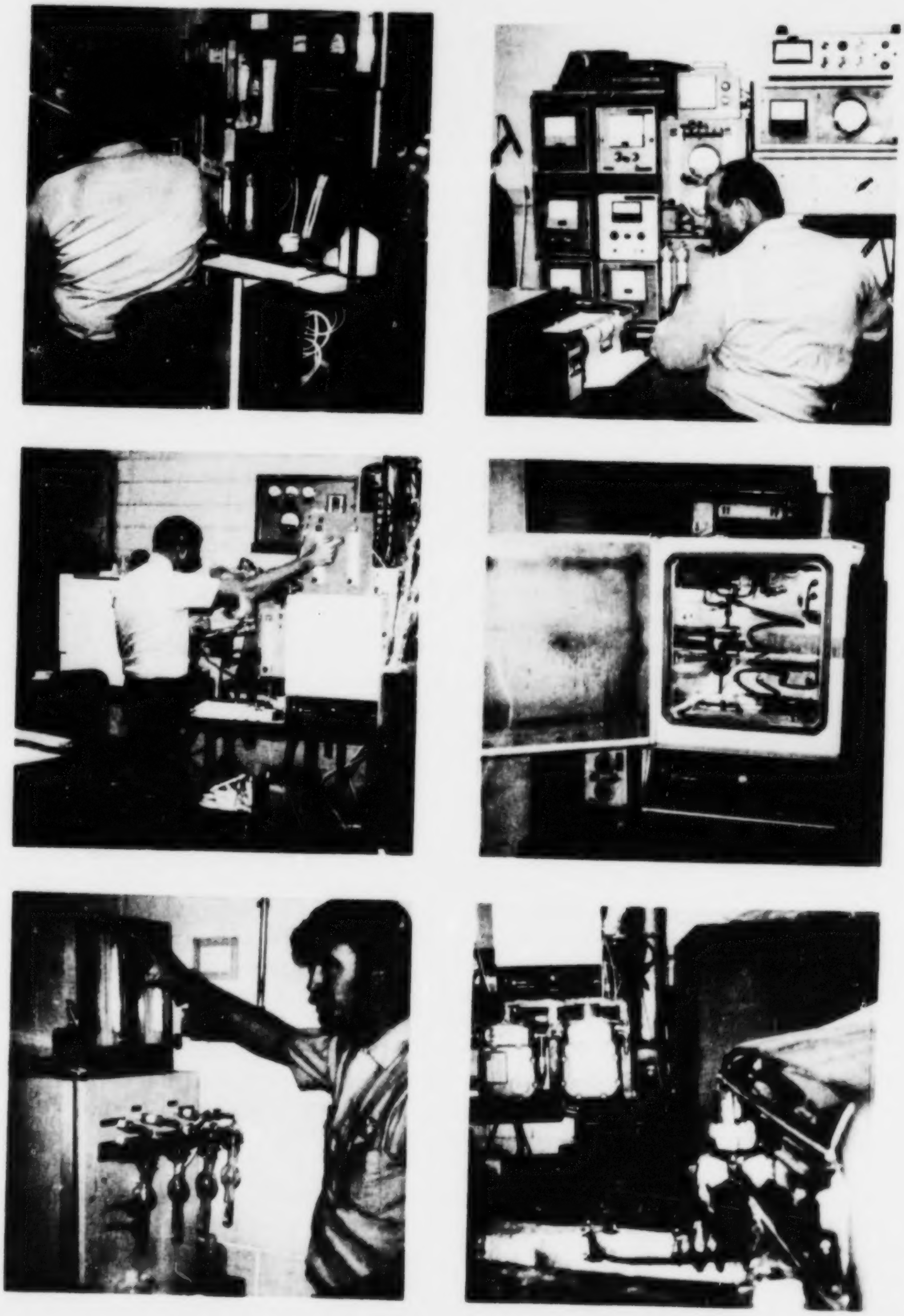

FIGURE 7. MEASUREMENT OF CO, HC, NO_x, AND OXYGENATES DURING ODOR TESTING

Because sampling requirements require a prescribed length of time to acquire enough sample for use in GC analysis, only steady state operation could be accommodated. The seven odor test conditions were specified for HC analysis. As an experiment, it was also desired to use the DOAS sample taken during the running of an entire 1975 LD FTP. This sample, taken at a continuous rate from the CVS diluted exhaust, was felt to represent as well as any other simple technique, the type HC usually emitted by diesels in transient operation. Therefore, some data under mostly transient (LA-4) type operation was obtained. Since some methane is present in the CVS dilution air, a background correction of an average of 2.2 ppmC was made to the methane readings in the CVS sample bag.

Although the method described worked satisfactorily with the cars operating on diesel fuel, the five cars running on gasoline posed some special problems. For these cars, the Ford LTD, both Capris, Cricket TCCS, and Honda CVCC, the analysis covered basically the C_1 to C_3 range. This was necessary since the boiling range of gasoline is much narrower and lower than diesel fuel. Small bag samples were taken during the steady state conditions and analyzed by a Varian 600-D gas chromatograph using a 3.05m x 3.18mm (10 ft x 1/8 inch) 80/100 phenylisocyanate/porasil C column held at 25°C. This permitted analysis of light hydrocarbons of methane, ethylene, acetylene, and propylene. This analysis was also satisfactory for ethane and propane; however, these two species were not observed above trace quantities except in a few of the cars operated on gasoline. The results thus obtained are reported on an observed basis.

c. Diesel Odor Analytical System

As one result of approximately five years of research, sponsored under the CAPE-7 project of CRC APRAC, A. D. Little developed a prototype liquid chromatograph for use in predicting diesel exhaust odor. Called DOAS for diesel odor analytical system, the system provides two results, one being an indication of the oxygenate fraction called LCO for liquid chromatograph oxygenates, and the other called LCA for liquid chromatograph aromatics. These were found by earlier research by ADL to represent the major odorants in diesel exhaust. The ADL studies had shown a correlation of the TIA (total intensity of aroma) to sensory measurements by the ADL odor panel. TIA is equal to $1 + \log_{10}$ LCO.

Both LCO and LCA are expressed in micro-grams per liter of exhaust using either the test fuel or a reference component for calibration. The LCO is, by virtue of its use to express TIA, considered the most important indication of diesel exhaust by this method. An entire series of reports have been published by ADL describing their work with diesel odor(25-29). Reference 29 describes the DOAS and its use, while Appendix C in this same reference describes the sample collection procedure. Rather than repeat these instructions, this section will describe how the system was employed in this series of tests.

Until the prototype was furnished SwRI, one of the first three built by ADL, the DOAS had been limited primarily to in-house ADL development tests. Their work was based on a Detroit Diesel 4-71 engine generator set. Although several fuels and injectors were tried, these tests of a direct odor panel-DOAS type were limited to the single exhaust odor source. Tests by Caterpillar with their in-house DOAS and samples from Cummins and Detroit Diesel, as a part of the CAPE-7 project, had demonstrated the DOAS to work with exhaust from a variety of engine makes and design.

With the availability of this potentially useful odor prediction method, it was decided to obtain simultaneous DOAS values with the trained SwRI odor panel on all the vehicles in this project, if possible. Recall the DOAS does not measure odor, but measures a class of odorants and that it was intended and developed specifically for use with diesel exhaust. Its application to exhaust from gasoline engines had never been attempted. Serious reservations were voiced over its use with gasoline exhaust, complete lack of calibration standards, etc.

Also, the prototype development by ADL had concentrated on the liquid chromatograph and the electronic integration and calculation of the LCO value to give a direct read-out of TIA based on a dialed-in sample volume. Little had been done on the specific sampling and trapping methods for collection of the sample except in the broadest general terms of sample flow, temperature, and time. Therefore, one of the first requirements was the design and fabrication of a suitable interface, beginning with the sampling probe and extending to the preparative or analytical trap.

The SwRI studies with the DOAS required only a single small analytical trap for LCO and LCA evaluation at each steady state condition. At the request of the Project Officer, duplicate analytical traps were taken as well as the larger preparative trap for use in EPA Research Triangle studies in-house and under contract to ADL. Three completely independent interface trapping systems were provided to collect samples.

One system was used by SwRI on the three replicate runs of each steady state. The other two were for samples requested by Mr. John Sigsby, Office of Air Quality Planning and Standards, EPA, Research Triangle Park, N. C., and confirmed in his letter of January 25, 1974. Only samples from the four diesel cars were of initial interest to the Research Triangle EPA effort. Traps were not made available for the initial tests with the Nissan powered Datsun car. Samples were trapped on the other three diesel cars as requested.

The samples for Mr. Sigsby were taken at three conditions, namely, idle and half load at high and intermediate engine speeds. Generally, it required six replications to sufficiently load the larger preparative trap so one of the sampling systems was developed to this use. All preparative traps were forwarded directly to ADL as advised by Mr. Sigsby. The other sampling system was used to take the smaller analytical traps so that replications 1, 3, and 5 were taken for subsequent analysis by ADL and replications 2, 4, and 6 were provided to Mr. Sigsby for analysis by the EPA Research Triangle Laboratories. One of the original three ADL prototype DOAS units was obtained by EPA for in-house testing. Normally, the steady-state odor runs were run in triplicate but for idle and the two half-load conditions the number of replications was increased to six.

To keep from disrupting the usual schedule, the additional three runs were normally made in the late afternoon after the transient evaluations. To obtain DOAS samples requires each test mode to be extended. Double the running time, from a nominal three minutes to six minutes, was needed to allow a full five minutes of trapping. The first minute is to achieve a stable operating speed and load. Panel evaluation is normally during the third minute of the run. No serious problems of tire or engine overheating were encountered with this schedule.

The sampling interface system is shown by the various photos in Figure 8. Since the constraints of this project did not allow much in the way of development of this interface, good laboratory practice as applied to diesel hydrocarbon measurement was followed. The three systems were identical and utilized a common oven held at 190°C (375°F). Each system consisted of a multi-opening stainless steel probe, as is normal practice for HC measurement from HD diesel engines. The sample was then transferred to the oven via a 9.5mm (3/8 inch) diameter stainless steel line 0.75m (30 inches) long covered by tubular exterior electrical heating sleeves to maintain 190°C (375°F) sample gas temperature. Between the probe and sample transfer line, a high temperature bellows type stainless valve was placed for leak check purposes. Inside the oven, the sample passed through a fiberglass filter, then into a square head welded metal bellows (stainless) pump head mounted inside the oven. Note these components in the upper right photo of Figure 8 are such that the pump motor drive is exterior of the oven. A small fan helps to keep the motor cool.

Immediately as the flow exits the oven wall, the DOAS trap is mounted so that it is accessible for change but is not located where the sample could have intentionally cooled. This is shown by the center right photograph where an analytical size trap is in use. Once the sample passes through the trap, the sample goes through a drierite column, a

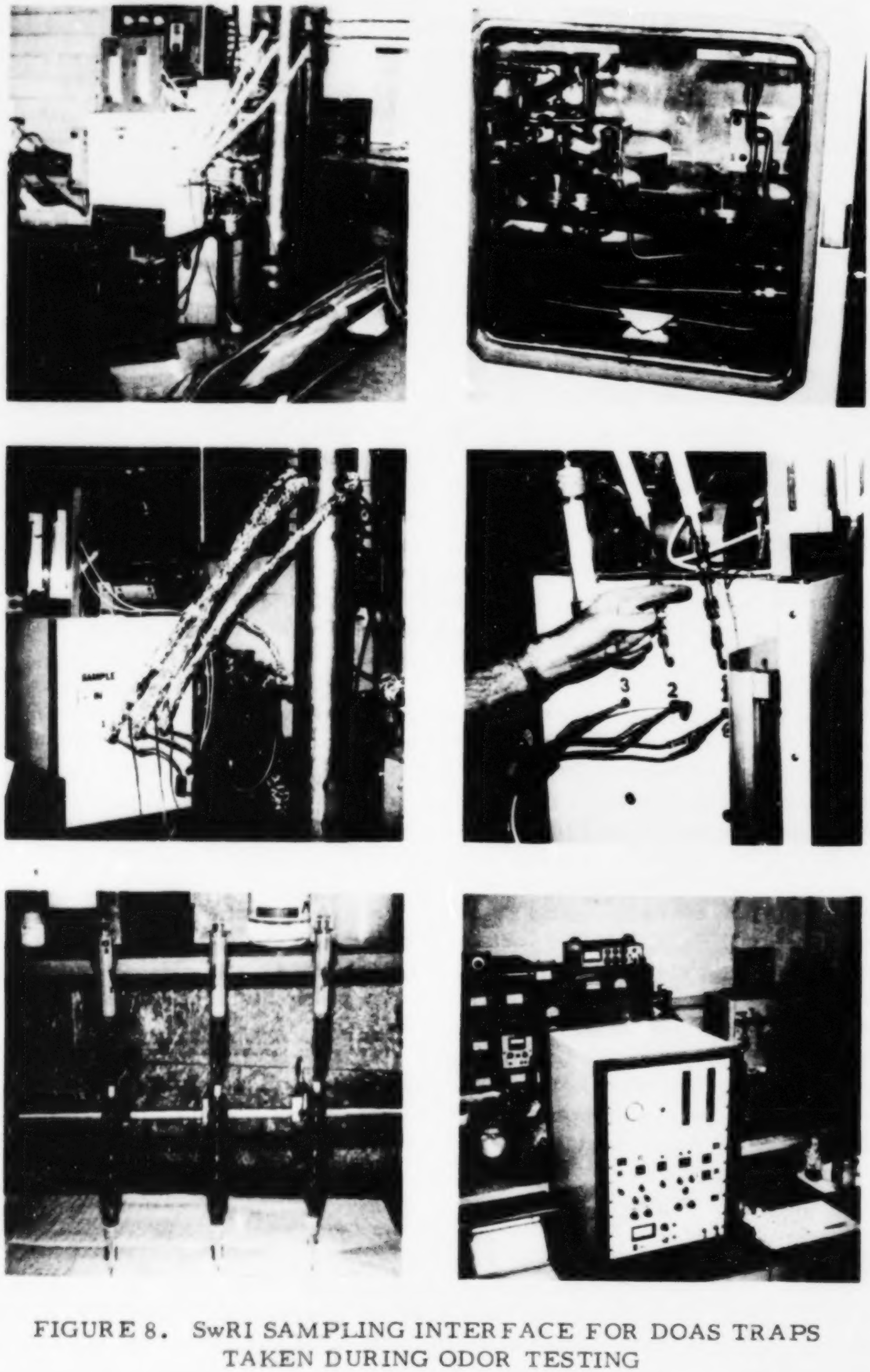

FIGURE 8. SwRI SAMPLING INTERFACE FOR DOAS TRAPS TAKEN DURING ODOR TESTING

glass tube flowmeter, and then into a dry gas volume meter. The dessicant removes troublesome water which condenses in the flowmeter and gas meter. The flowmeter allows monitoring of gas flow, by visual observation, during the test while the gas meter measures the total flow of gas during the test run.

Essentially no verification or parametric studies of this interface have been made to date. The temperature and flow scheme, rate, etc., are all subject to improvement. The effect of these variables singly and in combination on trapping efficiency remain to be determined. The exact temperature, flow rate and sample time given the trap proper is of concern. For example, it currently begins at room temperature and then warms-up significantly during the five minute sampling time as more and more hot sample is handled. The definition of sample volume necessary for the DOAS understandably depends on concentration of odorous contaminants. Using the sampling procedure in Appendix C of Reference 29, the best sustained flow possible in any of the three systems using the specified model 155 Metal Bellows pumps was about 5 l/min, about 50 percent of the ADL recommended flow. Although this flow was less than the recommended flow of 10 l/min, it was considered satisfactory.

The larger preparative traps generally had the same flow rates as the analytical traps but significantly longer sampling periods were required. These prep traps were designed to contain ten grams of the Chromosorb 102 rather than the one gram in the smaller analytical traps. Since no background emissions or odor data was available on any of the engines, it was basically a guess on how much sampling would be sufficient for adequate preparative trap loading. In the case of the cars operating on the 1975 FTP transient LA-4 test, it was estimated that the long sampling time of 31.4 minutes would compensate for the intentionally diluted (estimated 5 to 7:1) exhaust by the CVS method. Recall the dilution level was held to a minimum to prevent over-dilution of the already air-rich diesel exhaust. This was one of the major reasons for doing so. The trapping of four replicate 31.4 minute duration runs on a single preparative trap was only an educated guess. As may be seen, these DOAS interface, trapping, and sampling conditions are rather preliminary and in need of substantial further study.

The lower left photo of Figure 8 shows several of the small analytical traps being washed by the cyclohexane solvent. The lower right photo of Figure 8 shows the DOAS liquid chromatograph instrument, prepared by A. D. Little, and the recorder.

4. 1974 HD Diesel Smoke FTP

The Federal smoke test, promulgated in 1968 (Reference 31), was the basic smoke evaluation procedure utilized. It was improved and more stringent standards adopted in 1972(20) for 1974 certification purposes. There currently is no recognized U. S. smoke test procedure for light duty passenger car exhaust. Although the heavy duty schedule of speed and load versus time can be used with the light duty vehicle by a chassis dynamometer version of the test, it is uncertain whether this test is indeed representative of the way the smaller, higher speed diesels operate. Specifically, engine rated speed is considered higher than that normally encountered in passenger cars in urban use.

Replicate smoke tests were made using a chassis version of the FTP on all cars and by two other tests on selected cars. One was a smoke-power curve in which the engine was run in 400 rpm increments and smoke measured at full power throughout the range of operating engine speed. The other was to continuously record the smoke during operation of the vehicle over the LA-4 transient driving schedule featured in the Federal light duty gaseous emissions test.

Figure 9 shows various views of several of the test cars as prepared for the smoke tests. Note the short 0.61 meter (24 inch) exhaust pipe extension of 50.8mm (2 inch) exhaust pipe. The PHS smokemeter is mounted at the end of this pipe so that the centerline of the light beam is 127mm (5 inches) from the tip of the pipe. The usual light duty water brake Clayton 200 hp chassis dynamometer with belt drive inertia system was employed. Figure 9 also shows the multi-pen strip chart recorder used to monitor smoke opacity, vehicle and/or engine speed. The usual driving aid was used to drive the LA-4 trace.

Figure 10 is a schematic of the Federal HD smoke test. It consists of an initial engine acceleration from 150-250 rpm above the low idle speed to 85-90 percent of rated engine speed in 5.0 ± 1.5 seconds, a second acceleration from peak torque speed (or 60 percent of rated speed, whichever is higher) to 95-100 percent of rated speed in 10.0 ± 2.0 seconds, and (following this second acceleration) a full-power lugdown from 95-100 percent of rated speed to the particular intermediate engine speed (peak torque speed or 60 percent of rated speed) in 35.0 ± 5 seconds). Three of these sequences constitute one smoke test.

The average smoke opacity from the 15 highest-valued one-half second intervals of the two accelerations determine the "a" factor, and the average opacity from the five highest-valued one-half second intervals of the lugdown mode determines the "b" factor. The maximum values allowed for "a" and "b" factors of 1970 through 1973 certification engines were 40- and 20-percent opacity, respectively. For 1974, the "a" factor was reduced to 20-percent opacity and "b" factor was reduced to 15-percent opacity. The new peak or "c" factor, which is the average of the three highest one-half second intervals per cycle, is determined from the "a" and "b" chart readings. The three cycle "c" values are then averaged

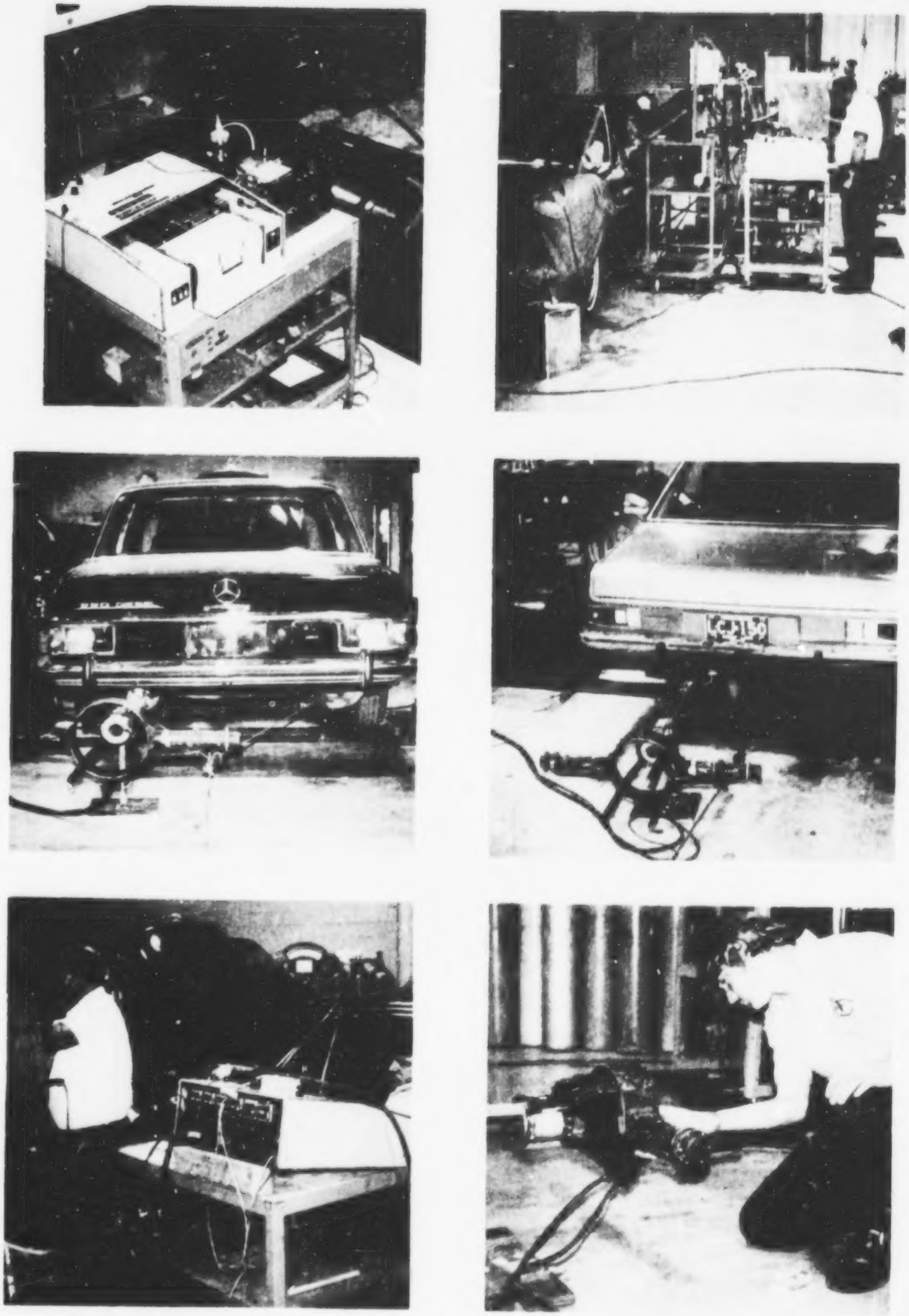

FIGURE 9. EXHAUST SMOKE MEASUREMENT EQUIPMENT AND INSTRUMENTS

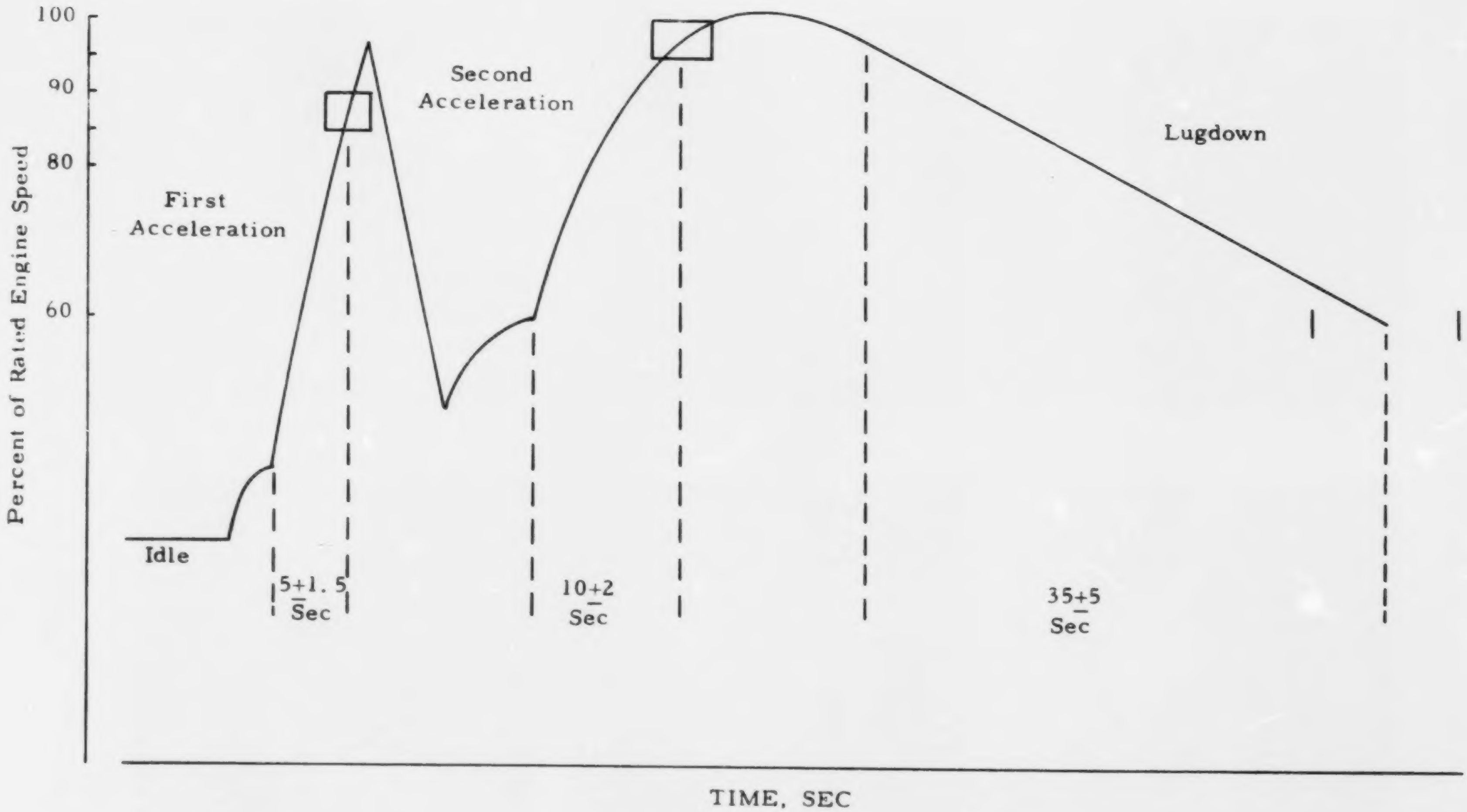

FIGURE 10. SCHEMATIC OF ONE CYCLE OF FEDERAL SMOKE COMPLIANCE TEST - ENGINE SPEED VS TIME

to determine the "c" factor for the test.

5. Vehicle Noise

This series of tests was intended to determine the maximum interior and exterior sound levels, in dBA scale, during idle and various driving modes. SAE J986a, Sound Level for Passenger Cars and Light Trucks, describes a test procedure that formed the basis for measurement and vehicle operation. A General Radio Type 1933 Precision Sound Level Analyzer, General Radio Type 1562-A Sound Level Calibrator, and General Radio Wind Screen, meeting the requirements of International Electrotechnical Commission Publication 179, were used. Interior and exterior measurements can be made simultaneously, if desired, by using two such precision sound level meters.

a. Acceleration Drive-by

Exterior drive-by measurements were made at 15.24m (50 feet) using the test procedure outlined in SAE J986a. Under this test, each vehicle approached a line 7.6m (25 feet) before a line through the microphone normal to the vehicle path and accelerated, using the lowest transmission gear or range such that the front of the vehicle reached or passed a line 7.6m (25 feet) beyond the microphone line when maximum rated engine speed was reached. The equipment used was a precision sound level meter, a sound level calibrator, and a calibrated wind screen. The test site was (as outlined in J986a) a flat open space, free of large reflecting surfaces (i.e., signs, hills, buildings) within 30.5m (100 feet) of the test track.

Measurements were made (as outlined in J986a) 1.22m (4 feet) above ground level and at 15.24m (50 feet) from the centerline of the vehicle. This distance was considered adequate if the maximum noise level as measured on the "A-weighted" scale with a "fast" meter response was 10 dB above the ambient noise level. If this criterion could not be met, the measurements were made at 7.6m (25 feet) by subtracting 6 dB from the measured values to extrapolate to an equivalent reading at 15.24m (50 feet). If the level at 7.6m (25 feet) was not 10 dB above ambient levels on a reasonably quiet day, this point was noted as well as the measured level and ambient level. The sound level for each side of the vehicle was the average of the two highest readings which were within 2 dB of each other. The sound level reported was that of the loudest side of the vehicle. Tests were made with all windows fully closed and the vehicle accessories such as heater, air conditioner, or defroster (radio excluded) in operation at their highest apparent noise level.

Interior sound level determinations were the same as exterior except that the microphone was located 0.152m (6 inches) to the right side of the driver's right ear. All other test procedures were as presented in J986a.

b. Constant Speed Drive-by

The exterior noise level with the vehicle passing by the microphone at a distance of 15.24m (50 feet) was measured. The vehicle was in high gear and driven smoothly at 48.3 km/hr (30 mph) ± 5 percent. As in the accel test, the measurement was made at 7.6m (25 ft) if "fast" meter response was not 10 dB above ambient noise level on the "A weighted" scale. Six dB was subtracted from the measured values to extrapolate to an equivalent reading at 50 feet. Interior sound level determinations were made in the same manner as during the accel test. The sound level reported for this test was obtained in the manner outlined in the acceleration test already described.

c. Idle

This test included sound level measurements at 3.05m (10 ft) distances from the front, rear, left (street side) and right (curb side) of the vehicle. The vehicle was parked and engine allowed to run at manufacturer's recommended low idle speed with transmission in neutral for at least one minute. Accessory items such as air conditioner or heater and defroster (radio excluded) operated at their highest apparent noise level. The sound level meter was positioned 3.05m from each bumper mid-way between the sides of the car and 3.05m from each side mid-way between the front and rear bumpers at 1.22m (4 ft) height above the ground. The vehicle was then turned around and headed in the opposite direction and measurements repeated. Interior measurements were also obtained at the same single point used in drive-by tests.

Figure 11 contains six photographs taken during typical noise tests of the cars. The two top photos give some idea of the course and the type of terrain where measurements were taken. The course was identical to that employed in the earlier work with the Mercedes 220 diesel as part of the Federal Clean Car Incentive Test Plan project conducted in 1971 for EPA(31). In fact, the test procedure described earlier in this subsection was identical to that developed and used in 1971. Figure 11 center photos also show typical locations around the car during the idle test.

The General Radio Precision sound level instrument is shown in the two lower photos of Figure 11. The left photo shows the tripod-held meter at 15.24m (50 ft) from the test course as a test car entered the "gate". The right photo shows the hand-held meter adjacent to the driver's right ear during the interior measurements.

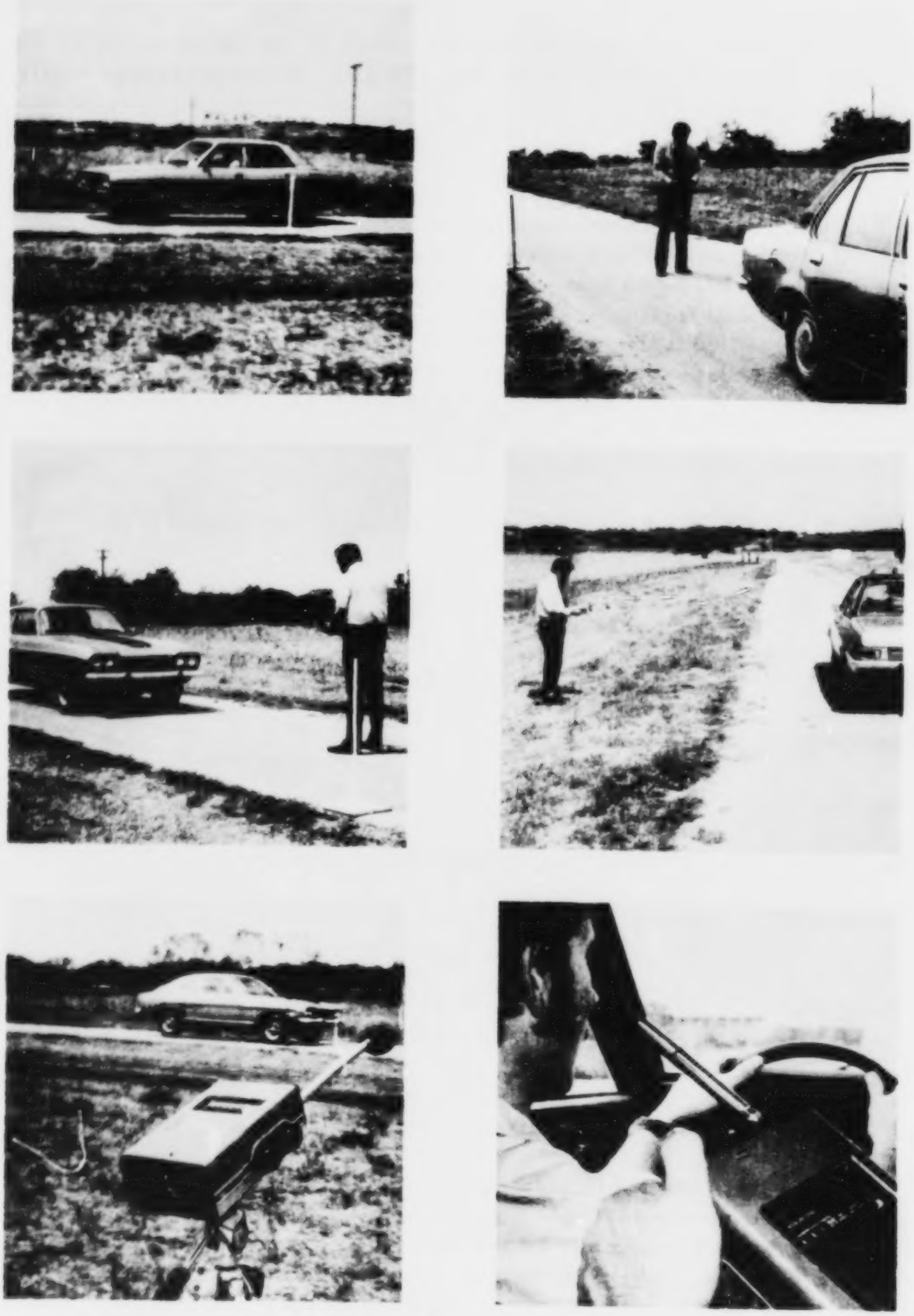

FIGURE 11. NOISE EVALUATION OF DIESEL, STRATIFIED CHARGE AND GASOLINE TEST CARS

IV. RESULTS

For simplicity, the results are described in the same order as the Experimental Test Plan, Table 3, and Section IIID, Procedures and Analysis, were discussed.

A. Light Duty 1975 FTP Results

The contractual requirement to report all data and results in modernized metric units (SI) requires a statement of equivalent emission standards for 1973 and later model year light duty cars in grams per kilometer (g/km) for understanding. Table 5 lists the HC, CO, and NO_x limits in g/km with those published in appropriate Federal Registers in g/mile in parentheses. The conversion was based on 1.609 km equal to 1 mile and were rounded to the same number of decimals as the published limit. The metric equivalent levels are approximately 62 percent of the mixed metric-English units.

TABLE 5. FEDERAL LIGHT DUTY EMISSION STANDARDS

Year	Units	HC	CO	NO_x
1973-1974	g/km (g/mile)	2.1 (3.4)	24 (39)	1.9 (3.0)
1975 Interim	g/km (g/mile)	0.9 (1.5)	9.3 (15)	1.9 (3.1)
Original 1975 Statutory	g/km (g/mile)	0.25 (0.41)	2.1 (3.4)	1.9 (3.1)
1977 Statutory	g/km (g/mile)	0.25 (0.41)	2.1 (3.4)	1.3 (2.0)
1978 Statutory	g/km (g/mile)	0.25 (0.41)	2.1 (3.4)	0.25 (0.40)

1. HC, CO, and NO_x Emission Rates

Table 6 lists the replicate run results and their average for the seven cars tested by the 1975 LD FTP. CO, NO_x, and HC by two methods are listed in g/km. In the case of the four diesel cars and the diesel-fueled TCCS Cricket, the HC by continuous method should be used in comparing to the Table 5 standards. The bag method HC results for the gasoline powered PROCO Capri, TCCS Cricket, and CVCC Honda should be compared to the standards as this is the proper method for gasoline cars. It is interesting to consider the differences in HC by bag and

TABLE 6. 1975 FTP LIGHT DUTY EMISSION AND FUEL ECONOMY RESULTS

		Diesel Powered				Stratified Charge Powered			
							Texaco TCCS		
Emission Category	Run No.	Nissan Summer	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford PROCO	Diesel	Gasoline	Honda CVCC
CO, g/km	1	0.95	0.88	1.57	0.72	0.43	0.88	0.27	3.50
	2	0.85	0.60	1.47	0.63	0.43	0.87	0.21	3.25
	3	0.60	0.59	1.26	0.51	0.61	0.87	0.21	3.19
	4	0.94	0.55	1.56	0.58	0.77	-	-	-
	Avg.	0.84	0.66	1.47	0.61	0.56	0.86	0.23	3.31
NO_x, g/km	1	0.98	0.73	0.63	0.83	0.88	1.25	1.16	0.97
	2	0.98	0.82	0.63	0.89	0.89	1.48	1.33	0.95
	3	0.89	0.72	0.61	0.77	0.84	1.07	1.21	0.92
	4	0.94	0.74	0.59	0.77	0.96	-	-	-
	Avg.	0.95	0.75	0.62	0.82	0.89	1.27	1.23	0.95
HC, g/km bag method(1)	1	0.11	0.08	0.38	0.09	0.10	0.47	0.66	0.57
	2	0.10	0.08	0.37	0.10	0.07	0.54	0.72	0.54
	3	0.09	0.07	0.33	0.09	0.22	0.51	0.77	0.50
	4	0.12	0.06	0.37	0.10	0.13	-	-	-
	Avg.	0.11	0.07	0.36	0.10	0.13	0.51	0.72	0.54
HC, g/km Continuous(2)	1	0.22	0.14	1.25	0.21	0.05	1.06	0.74	0.54
	2	0.22	0.15	1.30	0.22	0.07	1.35	0.68	0.66
	3	0.21	0.17	1.10	0.22	0.17	1.24	0.59	0.51
	4	0.22	0.14	1.21	0.29	0.14	-	-	-
	Avg.	0.22	0.15	1.22	0.24	0.11	1.22	0.67	0.57
Fuel Economy Carbon Balance km/litre (Based on HC Cont)	1	10.3	11.9	11.2	10.4	10.4	11.7	11.4	9.8
	2	10.6	11.7	11.0	11.1	10.7	11.7	9.9	11.2
	3	11.3	11.9	11.2	11.6	10.2	11.8	10.5	9.9
	4	10.3	12.8	11.9	11.1	10.3	-	-	-
	Avg.	10.6	12.1	11.3	11.1	10.4	11.7	10.6	10.3
Fuel Economy Weighed km/litre	1	10.0	10.5	10.1	9.5	8.9	11.4	10.2	10.1
	2	10.3	11.2	9.3	10.1	9.5	11.9	10.7	10.1
	3	10.2	11.2	10.3	10.5	9.8	11.6	10.7	10.5
	4	10.2	11.4	10.4	10.8	10.1	-	-	-
	Avg.	10.2	11.1	10.0	10.2	9.6	11.6	10.5	10.2

(1) By Reference 20 for Light Duty Gasoline
(2) By Reference 4 for Light Duty Diesel

continuous methods for the two types of cars. In the original work with the Mercedes diesel car several years ago(1, 3), it was shown that the bag collected sample from the CVS would understate the actual diesel HC value as obtained by integrating a hot, continuously analyzed, sample by about 50 percent.

The HC (bag) to HC (cont) ratio for the Nissan was 0.49, the Mercedes was 0.48, the Peugeot was 0.30 and the Opel was 0.41 based on the average data listed in Table 6. The overall ratio for the four diesels is 0.42 or the bag method measures only about 42 percent of that by the continuous hot technique. In the case of the gasoline car, the continuous method was used as an experiment since no previous data has been published. The diesel hot FID was reduced from the usual 190°C (375°F) to 71°C (160°F) because of the lower boiling range and lack of knowledge of HC measurement of gasoline exhaust at elevated temperatures. The 71°C (160°F) was an arbitrary level to prevent possible moisture condensation and is consistent with other work performed with the specific analyzer. A lower temperature of 38-52°C (100 or 125°F) could be used since the flow is diluted and moisture condensation thereby prevented.

The average bag results for the PROCO, TCCS, and CVCC gasoline cars were 118, 107, and 95 percent of the average continuous HC, respectively. The overall average of 102 percent means the bag and continuous results are essentially identical. It is unknown whether this ratio is appropriate to gasoline cars in general or is somewhat dependent on the specific CVS and HC FID analyzer employed. Perhaps a much more inclusive project should be run where the same Beckman 400 analyzer used on the bag cart is used to monitor continuously the diluted CVS flow. The plan of test involved the same diesel FID for continuous analysis on both gasoline and diesel cars. These three cars did cover a range of combustion systems that, except for the Honda CVCC, used oxidation catalysts.

The Table 6 average CO, HC, and NO_x g/km emission rates may be directly compared to the Federal standards listed in Table 5. The original 1975 Federal statutory limit of 0.25 g/km (0.41 g/mi) HC was met by all cars except the Peugeot 504D, the Texaco TCCS, and Honda CVCC. CO was, for most cars, substantially below the original 1975 standard of 2.1 g/km (3.4 g/mi). The Peugeot hydrocarbons are known to be considered typical of their early production fuel injection system. This system has been reported to have been revised by the manufacturer such that hydrocarbon emissions are better controlled. How much improvement is possible remains to be verified. It is quite likely, based on the ease with which the Mercedes 220D diesel meets the 1977 and 1978 HC limit, that the Peugeot can be modified to meet the 0.25 g/km (0.41 g/mi) HC limit.

NO_x from the diesel fueled cars was within the 1977 statutory NO_x limit of 1.3 g/km (2.0 g/mi). All of the seven cars tested fell short of meeting the 1978 statutory limit (original 1976 statutory) limit of 0.25 g/km (0.40 g/mi) NO_x. In general, this is the most difficult to all known regulations on tailpipe emissions to meet and the range of the four diesels of 0.62 to 0.95 g/km NO_x is about 2.5 to 3.8 times the limit specified in the 1970 Amendments to the Clean Air Act. The four stratified charge cars ranged from 0.89 to 1.27 g/km, substantially higher than the limit by about a factor of four.

The potential for reducing NO_x to the 0.25 g/km level is uncertain for these cars. In the case of the diesel, insufficient research has been conducted to even offer an appraisal of the possibilities. There has been no incentive to conduct the needed research since until recently, the Mercedes 220D was the only diesel car offered in the U.S. and its sales have been limited. The uncertainties regarding the 0.25 g/km (0.4 g/mi) NO_x limit and whether it will be modified by subsequent amendments to the Clean Air Act have deferred industry research on the low NO_x diesel. In the event the 1.3 g/km (2.0 g/mi) interim limit is retained, then little change is apparently needed to meet such levels by these seven cars. NO_x levels lower than 1.3 g/km will require further research and development to demonstrate.

2. Fuel Economy

The fuel economy results are also shown on the bottom of Table 6. Listed first are the carbon balance results using the Federal Test Method based on the 1975 FTP. These results are based on the continuous HC measurements by heated FID. The repeatability of the carbon balance based km/litre fuel consumption values was quite good just as the emissions data were considered quite satisfactory. Listed at the bottom of Table 6 are fuel economy values, based on direct weighing of the fuel. Repeatability of this method based on dividing the total fuel consumed by the distance traveled of 17.86 km (11.1 mi) is considered satisfactory. This method does not, by necessity, include the 43 and 57 percent weighting factors used in the carbon balance method with the three-bag 1975 FTP. It was not practical to separately weigh the fuel consumed during the first 505 seconds of the cold start 23 minute run by the equipment used.

The carbon balance method requires accurate measurement of CO_2 and accurate CVS air flow calibration using the propane check. Experience from these and a number of other simultaneous gravimetric-carbon balance fuel economy tests at Southwest Research Institute has shown agreement within ten percent. Usually the agreement is much better. Note the difference in methods for the Nissan was 4 percent, Mercedes 8 percent, Peugeot 11 percent, Opel and PROCO 8 percent, and 1 percent for the Texaco TCCS and Honda CVCC. Note that in each case, the gravimetric method was lower, indicating poorer fuel economy, km/litre, than the carbon balance method. The consistent difference indicates either the CVS carbon balance method did not completely reconstitute the fuel consumed either due to CVS calibration accuracy, CO_2 determination, etc., assuming the weighting factors discussed earlier have little effect, or the gravimetric system is inaccurate and over-rates fuel consumed during the run. As far as the test experience at SwRI indicates, there is not enough known to explain all the possible differences in the two methods. Perhaps the extent to which both agree is in reality quite satisfactory when the vageries of both methods are considered.

3. Comparison to EPA and Previous SwRI Results

The CVS and attendant systems employed were carefully calibrated and checked according to the strict procedures specified by EPA. As a measure of the apparent accuracy of the SwRI results, they are compared on Table 7 relative to the results of two similar runs made by EPA in the Ann Arbor laboratories prior to shipment of the cars to SwRI. The results of the two EPA runs, provided for general information, are averaged. The average of the two EPA tests and the replicate SwRI tests indicate excellent agreement in most cases. In essence, these seven vehicles form an extensive cross-check of low emission vehicles between the two laboratories and attest to the fact that very similar results can be obtained by two laboratories using the same procedures, if done carefully. All SwRI gas analyzer calibration curves are in terms of EPA named "golden standard gases".

Two vehicles lacked the laboratory to laboratory agreement common with the other five. In the case of the Peugeot, there was a noticeable difference between the two laboratories, specifically in HC. This difference all but disappeared after the vehicle was retested on its return to EPA at the conclusion of the SwRI tests, thereby validating the SwRI four-run average. The Honda CVCC powered Civic car HC and CO did not correlate well between the EPA and SwRI data as shown in Table 7.

To investigate whether driver had an effect on the results of the Honda CVCC Civic car, Mr. Jerry Douyard of the EPA Ann Arbor laboratory drove several tests back-to-back with SwRI driver Tom Jack on November 11 and 12, 1974. In the three-month interim between July 25 and November 11, 1974, the Honda car was subjected to a wide variety of operation for evaluation of smoke, noise, odor and gaseous emissions by the 13-mode test. The 13-mode test, performed just prior to the operation with Mr. Douyard, is the most difficult test procedure in terms of engine performance.

The results of the two cold starts are summarized on the next page.

TABLE 7. COMPARISON OF SwRI AND EPA AVERAGE 1975 LD FTP RESULTS

Emission	Lab	Run	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Capri PROCO	TCCS Diesel	Honda CVCC
			Emissions, Grams per Kilometer						
HC	EPA	1	0.12	0.17	2.03	0.24	0.10	No	0.19
		2	0.16	0.19	2.11	0.24	0.09	EPA	0.28
		Avg.	0.14	0.18	2.07	0.24	0.10	Data	0.24
	SwRI	Avg.	0.22	0.15	1.22	0.24	0.13(1)	1.22	0.54(1)
CO	EPA	1	0.88	0.69	2.53	0.75	0.52	0.48	2.06
		2	0.79	0.68	2.50	0.74	0.20	0.72	1.62
		Avg.	0.84	0.69	2.52	0.75	0.36	0.60	1.96
	SwRI	Avg.	0.84	0.66	1.47	0.61	0.56	0.86	3.31
NO_x	EPA	1	0.89	0.99	0.66	0.80	0.90	1.09	0.78
		2	0.80	1.04	0.70	0.80	0.96	1.17	0.83
		Avg.	0.85	1.02	0.68	0.80	0.93	1.13	0.81
	SwRI	Avg.	0.95	0.75	0.62	0.82	0.89	1.27	0.95
			Fuel Economy, km/litre - Carbon Balance						
	EPA	1	11.8	11.3	9.9	10.1	9.9	12.3	11.7
		2	12.0	12.5	9.6	10.1	10.0	11.8	10.7
		Avg.	11.9	11.9	9.8	10.1	10.0	12.1	11.2
	SwRI	Avg.	10.6	12.1	11.3	11.1	10.4(1)	11.7	10.2

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(1) Bag HC

Date	Driver	g/km HC	g/km CO	g/km NO_x	km/l Economy
11-11-74	Jack	0.26	2.53	0.73	10.46
11-12-74	Douyard	0.37	2.33	0.63	10.54

These results may be compared to those obtained earlier and summarized on Table 7, keeping in mind the time and operation of the engine in the interim. HC by driver Jack were essentially identical to EPA data of 0.24 g/km and, for some unknown reason, half the 0.54 g/km found earlier by SwRI. Both cold start runs, made on November 11 and 12, 1974, were made with the emergency brake set, the front wheel restraint chain looser than normal, and the ignition key intentionally held in start position with starter operating for five seconds. The cold start on November 11, 1974, by SwRI driver Jack was with 3 second hold period.

The cold start CO values were less than the 3.31 g/km measured earlier by SwRI but still above those measured by EPA of 1.96 g/km. The two drivers had results that repeated satisfactorily. NO_x by both drivers was less than either EPA or SwRI results listed on Table 7. During a thorough review of SwRI cold start procedures, it was found that the only difference of possible concern was the five second starter engagement during cold start. The printed instructions as furnished with the car implied an approximate five-second cranking time. This is the only car known to have a manual starter engagement of 5 seconds even with the engine already idling and this procedure as an emission certification requirement is seriously questioned. If such a requirement is deemed necessary by the manufacturer, then it should be in a programmed, automatic starting sequence like the gas turbine engine.

To investigate possible driver differences further, general back-to-back hot start tests were made which involved only the 23-minute first two bags of the 1975 FTP. The results are listed below:

Date	Driver	g/km HC	g/km CO	g/km NO_x	km/l Economy
11-11-74	Jack	0.26	1.65	0.74	10.62
	Douyard	0.25	1.55	0.65	10.84
	Jack	0.24	1.54	0.70	10.87
	Douyard	0.31	1.57	0.66	10.93
11-12-74	Jack	0.22	1.46	0.67	10.37
	Jack	0.23	1.44	0.70	11.06

The above results indicate no specific trends were apparent due to driver.

The last run on November 12, 1974, was made without holding the starter on for five seconds, with the tighter restraining tension and without the emergency brakes set. Comparing this final hot start against the other hot starts makes any specific conclusion regarding the restraint, etc., difficult. There seems to be little significance in these differences.

In summary of the additional Honda retesting, lower HC was found, essentially equal to that reported by EPA. CO and fuel economy was less than originally found by SwRI but greater than the EPA figures. NO_x was slightly below both original EPA and SwRI data. The reasons for these changes in values are unknown. The same driver, CVS, dynamometer, and inertia settings, bag cart, gas standards, gasoline, etc., were employed. Apparently the driver used by SwRI was not noticeably different from the driver used in the EPA tests from the cold and hot start back-to-back results.

One final comparison of the data is the currently tested Mercedes 220D with two similarly tested Mercedes 220D passenger cars reported in reference 1. In the previous test work, SwRI reported 0.54 g HC/km, 1.00 g CO/km, and 1.14 g NO_x/km and EPA, on a separate series of tests with a different car, reported 0.22 g HC/km, 0.86 g CO/km. and 0.96 g NO_x/km. Referring to Table 6, the SwRI results on this third Mercedes 220D are substantially lower in HC and somewhat lower in CO and NO_x than previous test results. One reason for the lower HC and CO was the use of an improved injection system featuring fuel "reverse flow dampening valves" at each injector for improved fuel injection.

The reason for the lower NO_x from this recent test series is not known. Later tests (discussed in the next section) revealed the fuel rate of the Mercedes engine was below specification at maximum power. It is doubtful this had a sufficient effect on NO_x during the transient LA-4 driving schedule to account for the difference since the driving cycle does not require much full power operation. NO_x is a direct function of power developed but, in the LA-4, the power required is dictated basically by vehicle weight in terms of inertia and to a lesser extent by road load.

4. Oxygenates

Several other emissions were measured during the course of the LD 1975 FTP. Table 8 lists the oxygenates and DOAS results based on a total single integrated sample of the entire 31.4 minute run. Aliphatic aldehydes are listed first and are computed in terms of grams of formaldehyde per km (density of formaldehyde is 0.814 g/litre), followed by formaldehyde. Acrolein, another partial oxygenate, is listed next based on a density of 2.29 g/litre. The MBTH and chromatropic acid methods

TABLE 8. OXYGENATES AND DOAS RESULTS - 1975 FTP

Emission Category	Run No.	Nissan Summer	Mercedes 220D	Peugeot 504D	Opel Rekord	Capri PROCO	Texaco TCCS Diesel	Texaco TCCS Gasoline	Honda CVCC
Aldehydes, g/km[1]	1	0.0251	0.0161	0.0383	0.0202	0.0081	0.0903	0.0561	0.0412
	2	0.0248	0.0150	0.0991	0.0191	0.0081	0.0868	0.0499	0.0429
	3	0.0329	0.0147	0.0940	0.0237	0.0073	0.1026	0.0300	0.0334
	4	0.0316	0.0192	0.0984	0.0269	0.0087	-	-	-
	Avg.	0.0287	0.0160	0.0820	0.0223	0.0081	0.0932	0.0453	0.0392
Formaldehyde, g/km	1	0.0216	0.0069	0.0275	0.0174	0.0025	0.0504	0.0225	0.0252
	2	0.0186	0.0136	0.0463	0.0180	0.0019	0.0676	0.0258	0.0272
	3	0.0189	0.0077	0.0442	0.0153	0.0012	0.0656	0.0231	0.0231
	4	0.0237	0.0128	0.0680	0.0198	0.0019	-	-	-
	Avg.	0.0210	0.010	0.0463	0.0175	0.0019	0.0612	0.0247	0.0252
Acrolein, g/km	1	0.0235	0.0098	0.0454	0.0177	0	0.0244	0.0141	0.0159
	2	0.0233	0.0134	0.0588	0.0234	0	0.0333	0.0137	0.0174
	3	0.0216	0.0079	0.0493	0.0176	0	0.0289	0.0083	0.0058
	4	0.0222	0.0140	0.0478	0.0199	0	-	-	-
	Avg.	0.0237	0.0117	0.0474	0.0196	0	0.0289	0.0120	0.0130
DOAS[2] TIA	1	0.9	0.7	1.2	0.7	0.3	1.2	0.5	0.3
	2	0.8	0.8	1.3	0.7	0.5	1.2	0.5	0.3
	3	ND	0.7	1.2	0.9	0.3	1.4	0.5	0.3
	4	1.0	0.8	1.2	0.7	0.3	-	-	-
	Avg.	0.9	0.8	1.2	0.8	0.4	1.3	0.5	0.3
LCO, µg/l	1	0.8	0.5	1.6	0.5	0.2	1.5	0.3	0.2
	2	0.6	0.6	1.8	0.6	0.3	1.6	0.3	0.2
	3	ND	0.5	1.5	0.7	0.2	1.8	0.3	0.2
	4	1.0	0.6	1.5	0.5	0.2	-	-	-
	Avg.	0.8	0.6	1.6	0.6	0.2	1.6	0.3	0.2
LCA, µg/l	1	7.5	2.0	24.1	3.3	0.5	25.4	4.1	4.5
	2	6.4	4.7	28.7	3.1	0.5	27.1	2.1	5.4
	3	ND	4.0	20.3	6.4	0.3	27.0	2.9	3.8
	4	12.1	6.2	23.5	4.7	0.3	-	-	-
	Avg.	8.7	4.2	24.2	4.4	0.4	26.5	3.0	4.5

[1] MBTH Aliphatic Aldehydes as Formaldehyde.

[2] CRC CAPE 7 Odor Instrument

have been conventionally used to measure aliphatic aldehydes and formaldehyde for lack of a better method. The precision of both methods, when applied to diesel exhaust, has been uncertain since insufficient research on interferences, calibrations, oxygenate balances, etc., has been performed. Accordingly, the oxygenate data, aldehydes, formaldehyde and acrolein, are presented for possible use in predicting exhaust odor and should be used only for relative comparisons.

The nature of the experiments, involving wet collection and subsequent colorimetric determination, precludes highly repeatable measurements. Until an improved oxygenate analysis method is developed, these measurements will likely continue to have unexplained high or low values, making replicate measurements mandatory.

Generally, unburned hydrocarbons and partially oxygenated materials go together, the more HC, the more aldehydes, formaldehyde and acrolein. Considering the HC in Table 6, it may be seen that as HC was less for the Mercedes, so were all three oxygenate measurements. And, as HC was substantially higher for the Peugeot, so were all three oxygenates. The Nissan and Opel engines produced fairly similar 0.22 and 0.24 g HC/km. Aldehyde, formaldehyde, and acrolein results were all slightly lower for the Opel than the Nissan, a "reversal" if small variations or differences can be considered valid trends.

Of importance was the substantially lower oxygenates (aldehydes, formaldehyde, and acrolein) during the 1975 FTP of the PROCO as related to the diesel cars and other stratified charge cars. Recall that a fairly good trend was established between HC and oxygenates by the four diesels. Although the LA-4 FTP HC results are only slightly lower for the PROCO than the Mercedes, the aldehydes and formaldehyde rates were quite low. Aldehydes from the PROCO were one-half and formaldehyde one-eighth that of the Mercedes. The HC for the gasoline fueled Texaco TCCS and Honda CVCC were about five to six times that of the PROCO and aldehydes likewise were five to six times different. Formaldehyde was ten times higher from the other stratified charge gasoline cars as compared to the PROCO formaldehyde g/km results. Acrolein could not be acceptably measured with the PROCO. Perhaps the oxidation catalyst equipped PROCO was effective in completing combustion of the partially oxygenated materials. This would be a noteworthy reason for catalysts if so, because some catalysts have been known to increase partial oxygenates under some conditions.

The oxygenate results can be compared to those reported earlier by SwRI in references 1 and 3. The average Mercedes 220D results from the 1971 tests were 0.012 g/km aldehydes, and 0.009 g/km formaldehyde, and 0.008 g/km acrolein. These values were based on using slowly bubbled exhaust from large bags instead of continuous collection throughout the run. The results do not compare too well when the exhaust HC differences are taken into consideration. It may be the previous bag method allowed condensation or other possible losses not accounted for and eliminated by the preferred continuous on-stream bubbling collection trap method used in this project.

Tests with a gasoline powered Mercedes 220 passenger car, also reported in References 1 and 3, indicated a much higher, four-fold higher, aldehyde value of 0.051 g/km and 0.047 g/km formaldehyde and 0.037 g/km acrolein. These increases tended to be consistent with the substantially higher HC for the gasoline than the diesel Mercedes 220. The gasoline powered cars similarly tested in this project resulted in varying results which are difficult to sort out due to the possible effect of the different catalysts used.

The PROCO was oxidation catalyst equipped and perhaps this combination of catalyst and stratified charge is the reason for the very low oxygenates even though gasoline-fueled. The TCCS, gasoline powered, gave much higher oxygenates yet on a par with the average of the four diesels. The TCCS was also equipped with an oxidation catalyst system, different from that used on the PROCO. Apparently this stratified charge-oxidation catalyst combination was not as effective on oxygenates. The Honda CVCC does not use a catalyst and yet its oxygenate values were quite consistent with the TCCS. This analysis and rough comparison to previous work is interesting yet far from conclusive. More work is necessary to separate the effect of the specific catalyst systems on oxygenate removal versus conventional and stratified charge gasoline engine oxygenate production.

5. DOAS Results by CAPE-7 Instrument

The bottom half of Table 8 lists the DOAS results obtained during the 1975 FTP. The total intensity of aroma (TIA) values are listed first, followed by the LCO and LCA values in micro-grams per litre. In essence, these values represent specific fractions of the organic or unburned fuel matter in the exhaust. The repeatability of measurement of the DOAS values during the entire 1975 FTP is somewhat like the formaldehyde, aldehyde, and acrolein measurements described earlier. In a word, the repeatability is haphazard and a number of replicate samples seem necessary to obtain a concensus. Prior to this test series, however, such measurements had never been done and for an experiment, the results and procedures look promising.

As with the oxygenate measurements, it is helpful to consider the correlation of the DOAS results to the HC results on Table 6 and the oxygenates. The LCO, TIA (TIA is $1 + \log_{10}$ LCO) and LCA were low as were the Mercedes HC and were high along with the Peugeot HC. The LCO and LCA values then decreased with the lower HC from the Opel. Recall the Opel and Nissan had about the same HC emission rate. The LCO (and TIA) values are fairly similar for the Nissan and Opel, but the LCA for the Opel was half that of the Nissan. This is quite interesting with regard to there being a possible shift in HC distribution to much fewer aromatics from the Opel.

The three gasoline powered stratified charge cars (PROCO, TCCS, and CVCC) had consistently low TIA (and LCO) values. The LCA, however, was low only for the PROCO, with the gasoline TCCS and Honda CVCC LCA approximately the same as the Mercedes 220D and Opel Rekord. The diesel fueled TCCS TIA, LCO, and LCA were almost identical to the Peugeot 504D. The diesel TCCS had double the HC (from Table 6) and oxygenates (from Table 8) as the gasoline fueled TCCS, but the TIA, LCO, and especially the LCA were significantly greater. The five to six-fold increase in HC and oxygenates for the TCCS (gasoline) and CVCC relative to the PROCO was not found in terms of TIA or LCO.

The TIA, LCO and LCA results for the gasoline powered vehicles represent a first attempt to use the DOAS with a fuel it was not originally intended to be used with. Accordingly, the results with the three gasoline fueled cars should not be considered in the same way as the five diesel fueled cars. The instrument was developed by ADL for diesel exhaust only and neither the interface or trapping media are necessarily appropriate to gasoline exhaust. Its performance in relationships with hydrocarbons or other oxygenate readings should be used with caution.

The possibility of measuring odor by use of the DOAS during a transient driving procedure is of some interest. This work has been helpful in this regard and represents a first. The long-term use of this method lies in the strength of the correlation between a trained panel of observers, odor panel, and the LCO-TIA results. To be able to use the method with the 1975 FTP, this relationship must be first demonstrated during a number of steady state operating conditions. This will be described in Subsection C of the Results.

6. Light HC and HC Distribution

Table 9 lists the light hydrocarbon and gas-liquid chromatograph HC distribution results from a single run of the four replicate 1975 FTP experiments. The light HC consist of methane, ethylene, ethane, acetylene, propane, and propylene by GC analysis of the CVS sample bags. Butane was not present in detectable levels by the method used. In some instances, such as the Nissan, PROCO, TCCS and CVCC, the methane present in the first bag, the 505 second cold start portion of the test, was much greater than during bags 2 and 3. Ethane, where

TABLE 9. LIGHT HYDROCARBON ANALYSIS AND GC HYDROCARBON DISTRIBUTION RESULTS FOR ONE(1) 1975 LD FTP

Exhaust Emission	Bag	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Capri PROCO	Texaco TCCS(4)		Honda CVCC
							Diesel	Gasoline	
Light hydrocarbons									
Methane, ppmC	1	7.9	3.0	3.5	3.0	12.5	23.5	4.4	8.2
	2	2.9	3.3	3.5	3.2	1.5	9.0	2.5	1.2
	3	2.9	3.0	3.8	2.9	2.4	10.7	2.6	2.0
Ethylene, ppmC	1	3.0	0.7	3.4	1.8	3.6	28.2	5.3	21.2
	2	0.9	0.4	2.8	0.7	0.5	2.8	1.3	4.1
	3	1.1	0.6	4.0	1.3	0.4	10.1	2.4	5.7
Ethane, ppmC	1	0.3	0.1	0.1	0.1	0.3	2.5	0.6	1.3
	2	0.1	0.0	0.0	0.0	0.1	0.7	0.3	0.7
	3	0.0	0.0	0.0	0.0	0.0	0.7	0.5	0.5
Acetylene, ppmC	1	1.2	0.3	1.1	0.3	5.5	10.4	1.1	9.0
	2	0.3	0.2	0.7	0.0	0.0	0.6	0.0	2.0
	3	0.5	0.3	1.2	0.0	0.0	2.3	0.2	3.2
Propane, ppmC	1	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.0
	2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0
Propylene, ppmC	1	0.6	0.0	1.0	0.5	1.4	9.1	3.5	11.1
	2	0.0	0.0	0.9	0.0	0.0	1.4	0.6	1.0
	3	0.0	0.0	1.3	0.0	0.0	3.8	1.7	2.1
HC Distribution, mole %(2)									
$<C_{12}$		3.8	3.6	3.7	3.4	NR(3)	3.5	NR	NR
C_{12}-C_{13}		14.2	14.0	14.1	14.2	NR	14.3	NR	NR
C_{14}-C_{15}		36.5	36.8	37.2	36.6	NR	37.0	NR	NR
C_{16}-C_{17}		26.7	27.1	27.3	26.3	NR	26.5	NR	NR
C_{18}-C_{19}		17.0	16.8	16.6	16.9	NR	16.8	NR	NR
C_{20+}		1.8	1.7	1.1	1.6	NR	1.9	NR	NR

(1) Run 4 Diesel Cars, Run 3 PROCO

(2) HC distribution based on DOAS chromosorb 102 trapped sample for odor analysis

(3) NR - Not Run, Elution Solvent Interference

(4) Average of 3 runs

detectable, tended to follow the same trend as methane. Propane was only found in the TCCS exhaust.

Ethylene, acetylene, and propylene concentrations were consistently higher during bags 1 and 3, the cold and hot start 505 second portions of the test except for the PROCO. In the case of acetylene and propylene, none was found in the second and third bags from the PROCO, indicating the importance of warm-up and, of course, activation of the oxidation catalyst. Some idea of relative oxidation tendency of the four light HC's measured can be seen from the PROCO data. More or less, the four diesels acted like the PROCO when it came to acetylene and propylene. The Nissan and the Opel both had propylene present only in the first bag. Recall the Mercedes to have the lowest exhaust HC of the four diesels, the Peugeot the highest, and the Opel and Nissan about the same. This same trend is followed overall for the four diesels with respect to the four light hydrocarbons measured.

Of the three stratified charge (gasoline fueled), the TCCS was lowest in light HC concentrations overall and the PROCO highest in methane and CVCC highest in ethylene, ethane, acetylene, and propylene. The diesel fueled TCCS was highest in nearly all light hydrocarbons tested of all cars and all three bags.

In the lower half of Table 9 are the single LA-4 test HC distribution using the solvent extracted DOAS trapped sample injected into a temperature programmed GLC. The HC distribution results are in terms of carbon number and are grouped as less than C_{12}, greater than C_{20}, and at four groupings in between. This analysis is only appropriate to diesel fuel or middle distillate, higher boiling range, fuels. The gasoline powered PROCO, TCCS, or CVCC were not appropriate for this technique even though a trap sample was obtained for the DOAS instrument.

The mole percent gives an idea of the distribution of various molecular weight or boiling range materials. Note that C_{14} through C_{17} accounts for over 60 mole percent of the HC in the exhaust. Also note that about 3.5 to 4 mole percent of the HC are below C_{12}. It is interesting to note the uniformity of the exhaust from the four diesels and the diesel fueled TCCS. The fuel was identical in all tests and if it is assumed that the majority of the HC in the exhaust is indeed raw, unburned fuel, then it follows the GLC trace and resulting peaks should be very similar and calculated mole percents should be close. HC in the exhaust are not completely unburned fuel but apparently, they were not sufficiently affected by variations in the diesel engines to give markedly different HC distributions.

7. Additional Detail

Appendix A contains the full series of test data and computer print-outs for the replicate LA-4 1975 LD FTP run for all cars thus tested. The Appendix is organized by car; Nissan, Mercedes, Peugeot, Opel, PROCO, TCCS and CVCC, the same order tested and the same order listed on the text tables. Appendix Tables A-1 through A-4 are the Nissan results by continuous heated FID for HC. Tables A-5 through A-8 are the same four runs but based on HC measured from the CVS sample bags.

In like manner, Tables A-9 through A-16 are for the Mercedes 220D, Tables A-17 through A-24 are for the Peugeot, Tables A-25 through A-32 are for the Opel and Tables A-33 through A-40 are for the PROCO tests. Tables A-41 through A-47 are the TCCS (diesel), and Tables A-48 through A-55 are the TCCS (gasoline), while Tables A-56 through A-62 are for the Honda CVCC. Half of the tables of each set are continuous heated FIA and the other half are based on HC as measured by the conventional CVS bag. The continuous method results are most appropriate for the diesels while the bag HC results are proper for the gasoline powered vehicles.

B. 1974 HD Gaseous Emissions FTP Results

Table 10 lists the individual run results of the replicate gaseous emissions tests by the chassis alternative 1974 HD 13-mode procedure. The values are in grams of emission per kilowatt-hour (g/kw-hr). One g/bhp-hr equals 1.34 g/kw-hr. Generally two or three complete 13-mode tests were made and the repeatability found to be excellent.

Comparing the various cars, the Nissan and Mercedes had almost identically low HC and CO. The TCCS operating on either gasoline or diesel fuel had the lowest CO of all cars at a nominal 2 g/kw-hr. The Opel had slightly higher HC and CO than the Nissan and Mercedes. The Peugeot had the highest HC of all the cars by this test with the TCCS next highest followed by the PROCO and the Honda CVCC. CO was highest from the PROCO at 75.6 g/kw-hr and the Honda at 60.7 g/kw-hr next highest. The Peugeot was next highest at 7.3 g/kw-hr, about one-tenth that of the PROCO and CVCC.

NO_2 ranged from 3.71 for the Peugeot to 8.91 g/kw-hr for the CVCC. The range of values for the four diesels was 3.71 to 6.77 g/kw-hr. Except for the PROCO, with NO_2 of 5.73 g/kw-hr, the other stratified charge cars had higher NO_2, in the range of 8 to 9 g/kw-hr. This is about 50 to 75 percent greater than the values for the four diesels.

Combined $HC+NO_2$ for all cars ranged from 5.27 and 5.49 (Nissan and Opel) up to 12.36 g/kw-hr for the TCCS gasoline. The three stratified charge cars gave $HC+NO_2$ on the order of 9 to 12 g/kw-hr.

TABLE 10. AVERAGE 13-MODE GASEOUS EMISSIONS TEST RESULTS
(Chassis Alternative of Federal Procedure)
grams per kw-hr

Emission Rate	Run No.	Nissan Summer	Mercedes 220D	Peugeot 504D	Opel Rekord	Capri PROCO	Texaco TCCS Gasoline	Texaco TCCS Diesel	Honda CVCC
HC	1	0.455	0.474	5.759	0.738	-	4.028	3.436	1.996
	2	0.428	0.439	5.660	0.758	3.523	4.872	3.037	2.021
	3	0.436	0.417	5.750	0.763	4.016	-	-	-
	Avg.	0.44	0.44	5.72	0.75	3.77	4.45	3.24	2.01
CO	1	4.705	5.155	7.440	4.979	-	1.093	2.374	61.006
	2	5.139	4.909	7.032	5.098	71.456	1.223	2.533	60.402
	3	5.142	4.973	7.420	5.272	79.789	-	-	-
	Avg.	4.99	5.01	7.29	5.12	75.62	1.16	2.45	60.70
NO_2	1	4.695	6.694	3.534	4.662	-	8.035	8.556	8.996
	2	4.897	6.865	3.657	4.876	5.950	7.778	8.781	8.817
	3	4.897	6.746	3.951	3.726	5.501	-	-	-
	Avg.	4.83	6.77	3.71	4.42	5.73	7.91	8.67	8.91
$HC+NO_2$	1	5.150	7.168	9.293	5.400	-	12.063	11.991	10.992
	2	5.324	7.304	9.316	5.634	9.473	12.650	11.818	10.838
	3	5.333	7.162	9.701	4.489	9.517	-	-	-
	Avg.	5.27	7.21	9.44	5.17	9.50	12.36	11.91	10.92

Except for the Peugeot $HC+NO_2$ of 9.44 g/kw-hr, the stratified charge vehicles produced on the order of double the $HC+NO_2$ by the chassis version of the 13-mode test. The HC from the Peugeot was an average of 5.72 g/kw-hr which is about ten times that of the other diesel cars and slightly higher than the catalyst-equipped PROCO. The Peugeot $HC+NO_2$ was substantially affected by the HC produced.

The CO from the PROCO was substantially higher than the diesels at average of 75.59 g/kw-hr. Although the PROCO featured a precious metal monolith oxidation catalyst, it was unable to prevent copious quantities of CO from being produced during 75 and 100 percent of maximum power. The oxygen, HC, and CO readings during this condition indicated the catalyst was overloaded and a "CO breakthrough" occurred. The catalyst normally reduced HC and CO to very low levels but under the high load conditions of the 13-mode test, these contaminants, due to probably insufficient oxygen and catalyst surface area, were not reacted to CO_2 and water vapor. During the high load condition, the catalyst and much of the exhaust system glowed red.

The Honda CVCC does not include a catalyst and its CO was almost as high as the Peugeot. The high power points of 50, 75, and 100 percent all resulted in increasingly higher CO concentrations which brought about this result. The TCCS engine, combined with its oxidation catalyst arrangement, performed well insofar as CO is concerned.

One way to consider these results is to relate them or loosely compare them to published standards for HC, CO and NO_x for heavy duty gasoline and diesel engines. They are listed on Table 11. Direct comparison to these limits is not advised since the car engines are not intended for HD application in vehicles over 2722 kg (6000-lb) gross vehicle weight. Also, a chassis alternative procedure necessarily was used which may not yield exactly the same results as the Federally prescribed stationary test.

The uncontrolled diesels are all substantially lower in CO than the Federal and California limits which are intended for gasoline type HD engines. $HC+NO_2$ are all below the 1973 California-1974 Federal limit of 21.4 g/kw-hr. The 1975 California limit of 13.4 g/kw-hr was easily met by all cars. The Peugeot and Opel produced $HC+NO_2$ above the 1977 California HD limit, the most stringent HD regulation on the books. Recall that the four diesels were merely driven in and tested. No emissions control systems or intentional tinkering or adjustment was given the four diesel cars. The three stratified charge cars had $HC+NO_2$ below the 1975 California limit of 13.4 g/kw-hr. They were 50 to 75 percent above the 1977 limit, however.

Another way to consider the HD 13-mode test results is to examine

TABLE 11. HEAVY DUTY GASOLINE AND DIESEL EMISSION LIMITS

	Units	CO	$HC+NO_2$
1973 California and 1974 Federal	g/kw-hr (g/bhp-hr)	53.6 (40)	21.4 (16)
1975 California	g/kw-hr (g/bhp-hr)	40.2 (30)	13.4 (10)
1977 California	g/kw-hr (g/bhp-hr)	33.5 (25)	6.7 (5)

the ratio of the 1975 LD FTP to the 1974 HD FTP results for each contaminant. Although the procedures and units of measurement are quite different, some insight on the behavior of the same vehicle under very different type procedures may be learned. The ratio of HC and CO results were not grossly different for the four diesel cars. Except for the Honda CVCC CO and NO_x, the TCCS (gasoline or diesel) and the CVCC (HC only) had quite similar ratios of 13-mode to LA-4 FTP results.

The PROCO engine, however, showed an HC and CO ratio an order of magnitude different from the diesels, indicating the gross difference in results by the two procedures. Under the 1975 LD FTP, hydrocarbons and carbon monoxide were almost negligible for the highly controlled PROCO engine. Under the heavier duty test, the control system lost effectiveness and this resulted in the gross difference in behavior attributable to test conditions. The PROCO engine was developed and perfected to meet the 1975 LD FTP and it is not surprising that it did poorly by the HD procedure. The NO_x results by both tests produced a consistent ratio of results for all cars, meaning the results of one test could be predicted fairly well by the other test.

The final method of analyzing the 13-mode test results is to consider the modal data on the computer print-out sheets included as Tables B-1 through B-20. These print-outs list the concentrations, measured fuel and air rates, power outputs used, and the weighted brake specific emission values. These are combined and NO_2 corrected to the prescribed 10.7×10^{-3} g water per kg of dry air absolute humidity (75 grains water per pound of dry air). The final results are listed as cycle composite values in g per kw-hour. After each group of tables for a given diesel car, a graph is included to show the emission concentrations versus power level at the rated and intermediate speeds tested. The modal data plots, Figures B-1 through B-8, illustrate the behavior of the engine with speed and load.

The PROCO produced substantial HC and CO rates, per Tables

B-13 and B-14, during Modes 5 and 6 (75 and 100 percent load, 2400 rpm) and Mode 8 (100 percent load, 4000 rpm). This was when the "CO breakthrough" mentioned earlier occurred and accounts for the higher HC and CO from the PROCO than the uncontrolled diesels. The high HC of the Peugeot may be attributed to all modes of the test (Tables B-7 through B-9) and especially the light load modes, Modes 2 and 3 (2 and 25 percent load, 2700 rpm) and Modes 9, 10, and 11 (50, 25 and 2 percent load, 4500 rpm). This HC behavior is shown in Figure B-3.

Much more analysis of the modal data in Appendix B could be made, but it must be recalled that the HD test is not necessarily intended for the higher engine speed, smaller diesels used in passenger cars. The data can give valuable insight on the engines' performance but is not considered especially suited for or realistic of car operation. The selection of engine speeds is much too high for everyday operation. The use of 75 and 100 percent of maximum power should get some attention but should be weighted for less than the eight percent each mode as now given. Further use of the results beyond that discussed so far should be made with these qualifications in mind and caution exercised.

The only major concern with these results was the apparent low fuel rate of the Mercedes relative to manufacturer's values. For example, the engine should consume about 15.4 kg/hr (34 lbs/hr) fuel at rated speed and maximum load. Measured fuel rate on the specific Mercedes 220 diesel evaluated was 12.5 (27.6 lbs/hr) at 4200 rpm. Since this was the final test series run, the decision was to use the data thus far determined with the knowledge that for some unknown reason, the fuel rate and corresponding power output was low. No obvious reason could be found for this lower than desired fuel rate, though the vehicle, engine, and measuring equipment were thoroughly checked. Its effect on 13-mode results is expected to be minimal due to the brake specific type of expression employed.

C. Odor and Related Instrumental Analyses

This portion of the results will describe the odor and other measurements made simultaneously with odor ratings.

1. Evaluation by Trained Panel

As indicated earlier, the odor panel rated the exhaust of all the vehicles tested at the same 100:1 dilution level. The actual dilution of exhaust from a vehicle in service varies greatly depending on the driving mode, the position of the observer relative to the vehicle, the direction of the exhaust discharge, and the rate of exhaust flow. These many variables could not be accounted for in this study so an arbitrary decision

TABLE 12. LISTING OF AVERAGE ODOR PANEL RATINGS AT 100:1 DILUTION

Vehicle Condition	Odor Kit	Nissan		Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	TCCS Diesel	TCCS Gasoline		Honda CVCC	Chrysler Gas Turbine
		Winter	Summer								10/8/74	10/11/74		
						Steady State Results								
Intermediate Speed, no load	D	3.1	3.1	2.6	6.0	3.5	2.0	2.7	0.8	5.7	3.7	4.5	2.1	1.3
	B	1.1	1.1	1.0	1.9	1.2	0.8	0.8	0.4	1.9	1.3	1.4	0.7	0.8
	O	0.9	0.9	0.9	1.6	1.0	0.4	0.8	0.1	1.4	0.8	0.9	0.6	0.4
	A	0.7	0.7	0.5	1.0	0.8	0.6	0.5	0.2	1.1	0.7	0.8	0.6	0.3
	P	0.6	0.6	0.4	1.4	0.6	0.2	0.6	0	1.3	1.1	1.3	0.5	0.1
Intermediate Speed, mid load	D	2.8	3.0	2.6	4.1	4.2	1.5	3.0	0.8	5.4	2.8	3.2	1.5	1.1
	B	1.0	1.0	1.0	1.3	1.4	0.6	0.9	0.4	1.7	1.0	1.0	0.7	0.7
	O	0.9	0.9	0.9	1.1	1.0	0.3	0.8	0.1	1.2	0.9	0.8	0.5	0.3
	A	0.6	0.8	0.6	1.0	0.9	0.6	0.6	0.3	1.0	0.6	0.7	0.4	0.3
	P	0.3	0.5	0.3	0.8	1.0	0.2	0.7	0.1	1.3	0.7	0.8	0.2	0.1
Intermediate Speed, high load	D	3.8	3.7	3.4	4.7	3.7	1.2	3.4	1.0	5.0	3.4	3.0	1.5	1.1
	B	1.1	1.1	1.1	1.5	1.2	0.5	0.9	0.4	1.6	1.0	1.1	0.7	0.7
	O	1.0	1.0	0.9	1.1	1.0	0.4	0.9	0.2	1.3	0.8	0.8	0.5	0.4
	A	0.9	0.9	0.8	1.0	0.8	0.4	0.7	0.3	1.0	0.6	0.7	0.5	0.2
	P	0.7	0.7	0.8	0.9	0.7	0.1	0.8	0.1	1.2	0.8	0.6	0.2	0.1
High Speed, no load	D	2.4	2.1	2.6	6.0	3.3	1.5	2.2	0.8	6.1	3.9	4.1	1.9	1.0
	B	1.0	1.0	1.0	1.9	1.1	0.7	0.8	0.4	2.1	1.1	1.3	0.8	0.6
	O	0.8	0.8	0.9	1.7	1.0	0.4	0.6	0.2	1.5	1.0	1.1	0.5	0.2
	A	0.5	0.6	0.5	1.0	0.8	0.5	0.5	0.2	0.9	0.8	0.6	0.5	0.2
	P	0.3	0.2	0.4	1.4	0.6	0	0.4	0	1.5	0.9	1.2	0.4	0.1
High Speed, mid load	D	3.7	3.1	3.1	4.7	4.5	1.1	3.5	1.1	4.4	3.1	2.5	1.6	1.0
	B	1.3	1.1	1.1	1.5	1.5	0.5	1.0	0.5	1.4	1.0	0.9	0.7	0.7
	O	1.0	1.0	0.9	1.1	1.1	0.3	0.9	0.3	1.1	0.9	0.8	0.5	0.2
	A	0.7	0.9	0.6	0.9	1.0	0.4	0.6	0.2	1.0	0.6	0.5	0.6	0.1
	P	0.7	0.4	0.6	1.0	1.1	0	0.8	0.1	0.9	0.7	0.6	0.3	0.1
High Speed, high load	D	4.8	3.9	3.9	5.6	4.0	1.4	3.3	1.3	4.8	3.3	3.0	1.6	1.2
	B	1.7	1.1	1.2	1.8	1.3	0.7	0.9	0.5	1.6	1.1	1.0	0.7	0.7
	O	1.2	1.0	1.0	1.4	1.0	0.5	0.8	0.3	1.2	0.9	0.9	0.5	0.4
	A	0.9	0.8	0.8	1.1	0.9	0.4	0.7	0.4	0.9	0.7	0.6	0.5	0.3
	P	0.9	0.8	0.9	1.2	0.9	0.1	0.8	0.1	1.1	0.8	0.6	0.2	0.1
Idle Speed no load	D	2.9	2.7	3.1	4.8	3.3	1.2	3.3	0.7	5.3	2.7	3.1	3.2	1.5
	B	1.0	1.0	1.0	1.5	1.1	0.6	0.9	0.3	1.6	1.0	1.1	1.0	0.7
	O	0.9	0.8	0.9	1.2	1.0	0.4	0.8	0.1	1.2	0.8	0.8	0.8	0.4
	A	0.5	0.7	0.8	1.0	0.8	0.3	0.7	0.3	1.1	0.5	0.7	0.8	0.4
	P	0.4	0.5	0.6	1.0	0.5	0.1	0.8	0.1	1.3	0.4	0.9	0.9	0.2

TABLE 12 (Cont'd.) LISTING OF AVERAGE ODOR PANEL RATINGS AT 100:1 DILUTION

Vehicle Condition	Odor Kit	Nissan Winter	Nissan Summer	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	TCCS Diesel	TCCS Gasoline 10/8/74	TCCS Gasoline 10/11/74	Honda CVCC	Chrysler Gas Turbine
Transient Results														
Idle-Acceleration	D	3.5	3.8	4.0	5.6	5.0	1.0	2.6	1.0	5.7	2.5	3.0	3.4	0.8
	B	1.1	1.2	1.4	1.9	1.8	0.6	0.9	0.5	2.0	1.0	1.0	1.1	0.5
	O	1.0	1.0	1.0	1.4	1.2	0.3	0.9	0.2	1.3	0.7	0.6	0.9	0.2
	A	0.8	0.9	0.8	1.0	0.9	0.2	0.4	0.3	1.0	0.5	0.7	0.7	0.2
	P	0.7	0.7	0.9	1.3	1.4	0.1	0.5	0.1	1.7	0.5	0.8	0.9	0.1
Acceleration	D	5.6	5.0	3.4	6.0	3.8	1.9	3.2	3.1	5.0	2.5	2.8	4.4	0.8
	B	1.9	1.7	1.1	2.0	1.2	0.9	1.0	1.0	1.6	1.0	0.8	1.5	0.5
	O	1.4	1.2	1.0	1.6	1.0	0.6	0.9	0.9	1.2	0.7	0.9	1.0	0.2
	A	0.9	0.9	0.7	1.0	0.9	0.4	0.6	0.5	1.1	0.4	0.5	0.8	0.2
	P	1.4	1.1	0.9	1.4	0.9	0.3	0.7	0.9	1.1	0.5	0.7	1.1	0.1
Deceleration	D	4.9	5.1	3.7	5.5	3.4	1.7	2.9	0.8	4.9	2.3	2.7	2.6	0.9
	B	1.7	1.6	1.1	1.7	1.1	0.8	1.0	0.4	1.6	1.0	0.9	0.9	0.6
	O	1.2	1.2	1.0	1.4	1.0	0.6	1.0	0.2	1.1	0.6	0.9	0.8	0.2
	A	0.9	0.9	0.9	1.0	0.8	0.4	0.5	0.2	1.0	0.4	0.5	0.5	0.2
	P	1.2	1.1	0.8	1.2	0.7	0.2	0.5	0.1	1.2	0.4	0.6	0.6	0.1
Deceleration - Relight	D													0.8
	B													0.5
	O													0.2
	A													0.1
	P													0
Engine Starting Results														
Hot Start	D													1.3
	B													0.7
	O													0.3
	A													0.3
	P													0.1
Cold Start	D						2.0	3.4	4.3	4.5	3.8	3.1	4.1	3.7
	B						0.5	0.9	1.0	1.3	1.6	0.8	1.2	1.1
	O						0.5	0.9	0.8	1.0	1.0	0.7	0.9	0.9
	A						0.7	0.8	0.8	0.8	0.6	0.7	1.0	0.6
	P						0.2	0.7	0.9	1.1	0.8	1.0	0.9	0.9

Intermediate speed is 60 percent of high speed defined as the rpm in highest gear that coincides with 56 mph vehicle speed and level road load.
Mid load is fuel rate midway between no load (neutral) and high load fuel rates. Ford LTD, both Capris, and Chrysler gas turbine ran at four times level road load at 50 mph (full load) and two times level road load at 50 mph (mid load). Texaco TCCS and Honda CVCC were run at three times level road load at 50 mph (high load) and 1.5 times level road load at 50 mph (mid load). High speed (56 mph) and intermediate speeds based on preset road load settings at 50 mph.

was made to run all of the vehicles at the same 100:1 dilution level. The common dilution permits a judgement of the relative ratings of the raw exhaust, but the ratings should not be interpreted as necessarily relating to how the vehicles would rank in actual service. The ranking in the field requires judgements of the several factors affecting dilution which this limited study does not attempt to make.

Table 12 is a summary listing of the average odor panel ratings for each of the ten cars evaluated. Where possible, and starting with the Ford LTD, cold start odor ratings were obtained and replicated. In the case of the Chrysler gas turbine, two other conditions, a relight after decel and a hot start were added. Please see Table 4 for specification of test conditions.

Figures 12 through 22 illustrate the tabular data for each car. The top half of each figure is a plot of average "D" ratings versus power level for the six steady state speed and load conditions. These three point curves give some idea of the production of exhaust odor versus power and speed. In the case of the Nissan-Datsun, Mercedes 220D, standard Capri and PROCO Capri, the trend was a slight to moderate increase in "D" odor intensity with an increase in load on the engine. The Peugeot and Opel had opposite behavior to each other in that the Peugeot "D" ratings were sharply lower at half load than at no load and full load while the Opel peaked in "D" odor intensity at half load.

The Texaco TCCS (diesel fueled) had slightly different behavior at the two engine speeds. At 3000 rpm the mid load condition gave lower odor than at no load (highest) and high load. The 1800 rpm "D" ratings tended to decrease slightly as power was increased. For the gasoline fueled Texaco TCCS, the trend was more consistent with the diesel fueled TCCS at 3000 rpm. The mid power condition was always lower than the no load and, except for one instance, the high load condition.

Note on Table 12 and Figure 20 for the gasoline fueled TCCS, odor data is reported and plotted for two separate days. The reason for this is that during the usual repeat day of operation with this car, on October 10, 1974, the engine stopped running during the morning runs and could not be restarted. It was found that the distributor drive shaft had "backed out" sufficiently to kill the engine. On examination and after discussion with the staff of Texaco, it was learned that this had happened once before and was something which rarely occurred. The bevel drive gear is such that as it "backed out", a design deficiency in the distributor installation, the spark timing advanced. Normally, this happens gradually according to Texaco.

The distributor shaft was "pinned" to try and prevent a recurrence, reinstalled, and the basic spark timing set to specifications. The engine then started easily and was subject to twice daily timing

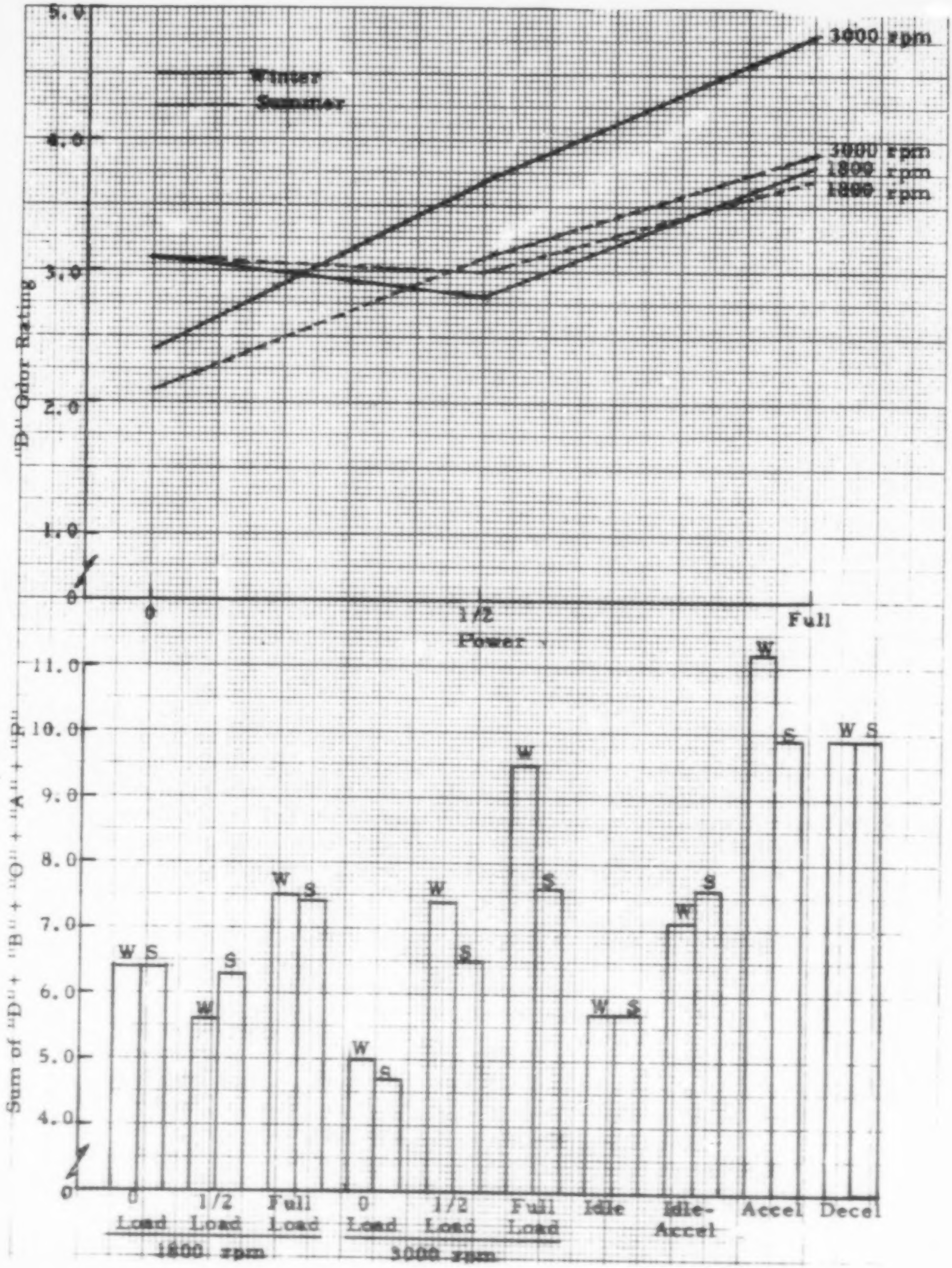

FIGURE 12. AVERAGE ODOR RATINGS FOR NISSAN-DATSUN DIESEL LIGHT DUTY VEHICLE AT 100:1 DILUTION

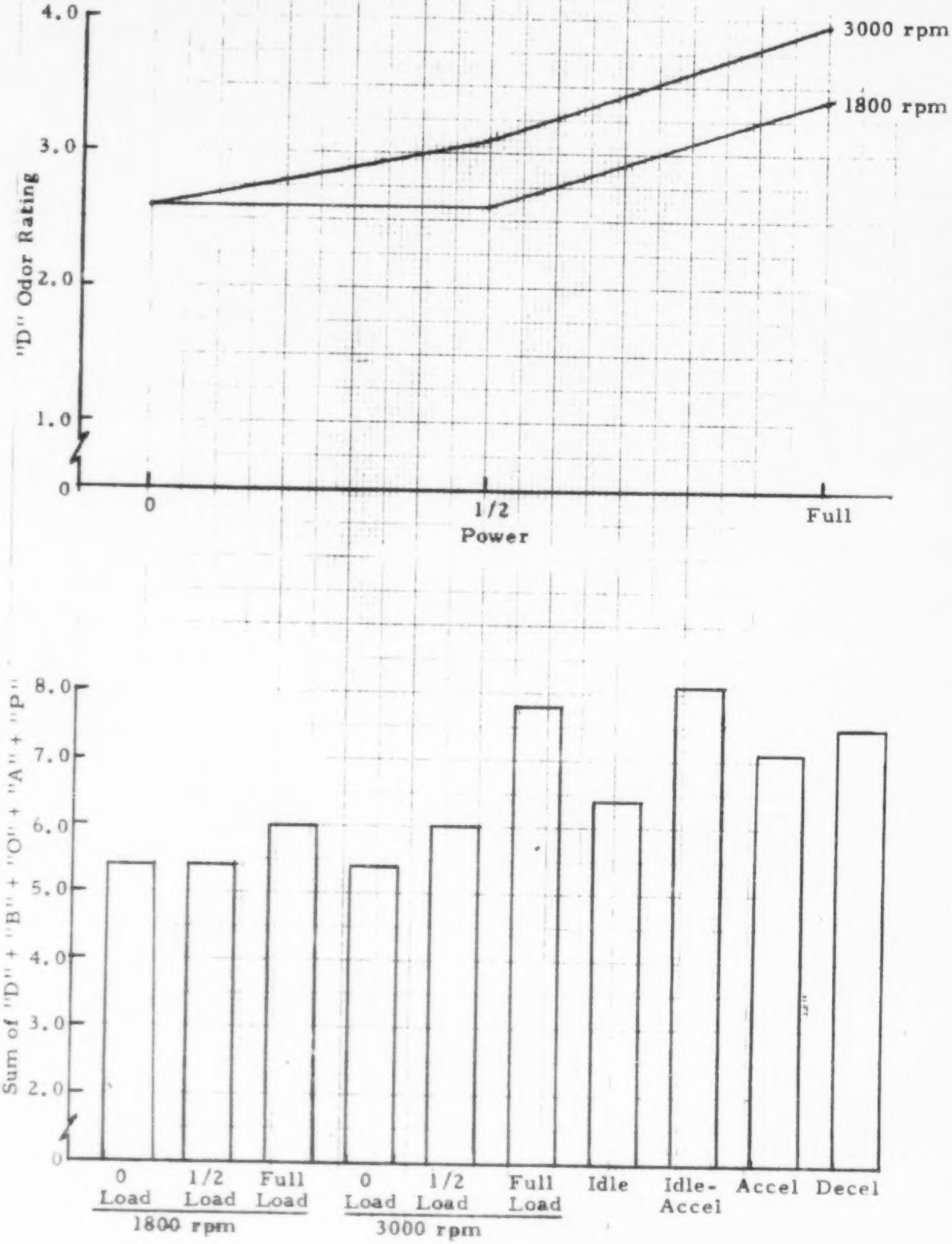

FIGURE 13. AVERAGE ODOR RATINGS FOR MERCEDES 220 DIESEL LIGHT DUTY VEHICLE AT 100:1 DILUTION

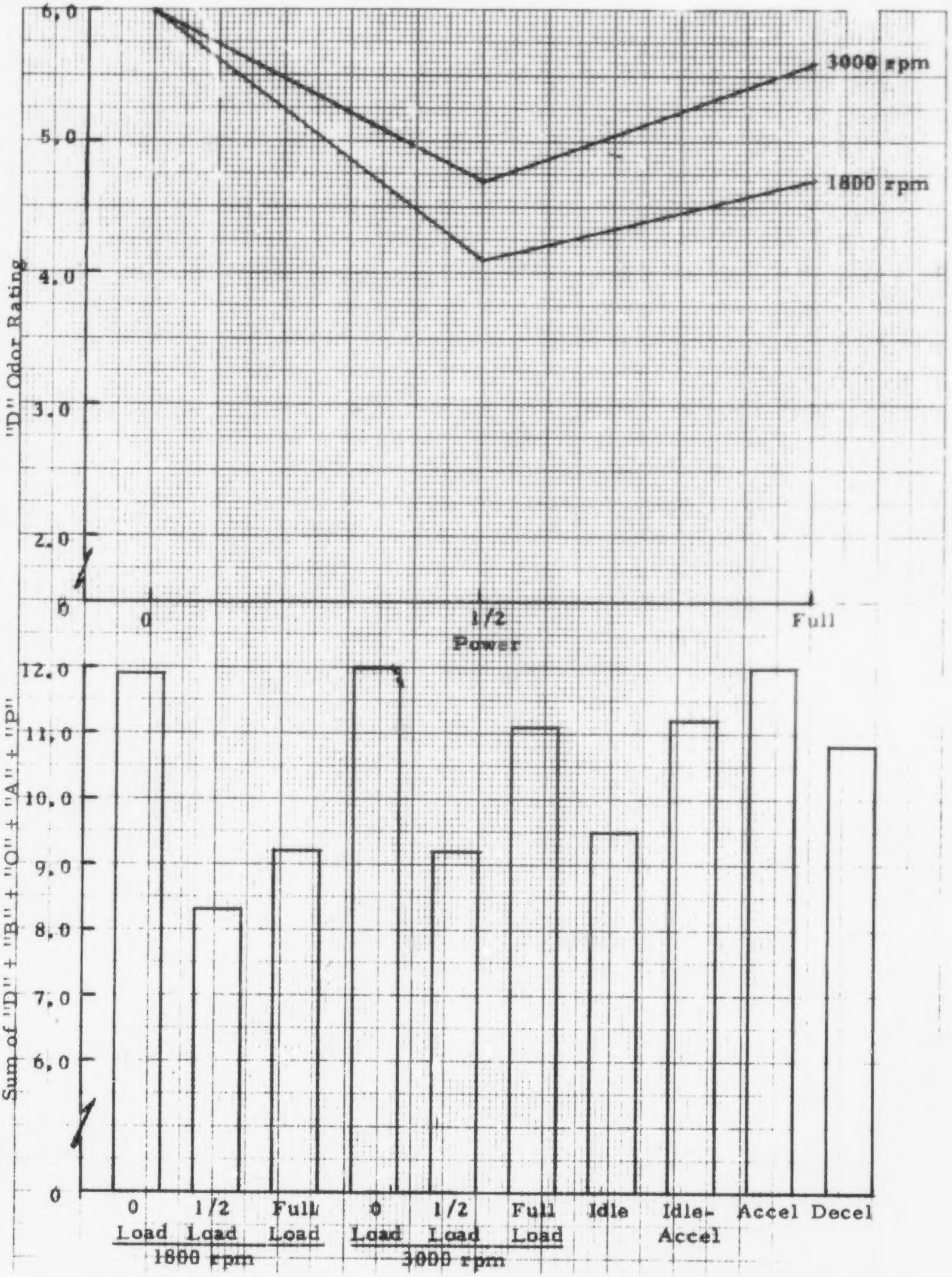

FIGURE 14. AVERAGE ODOR RATINGS FOR PEUGEOT DIESEL LIGHT DUTY VEHICLE AT 100:1 DILUTION

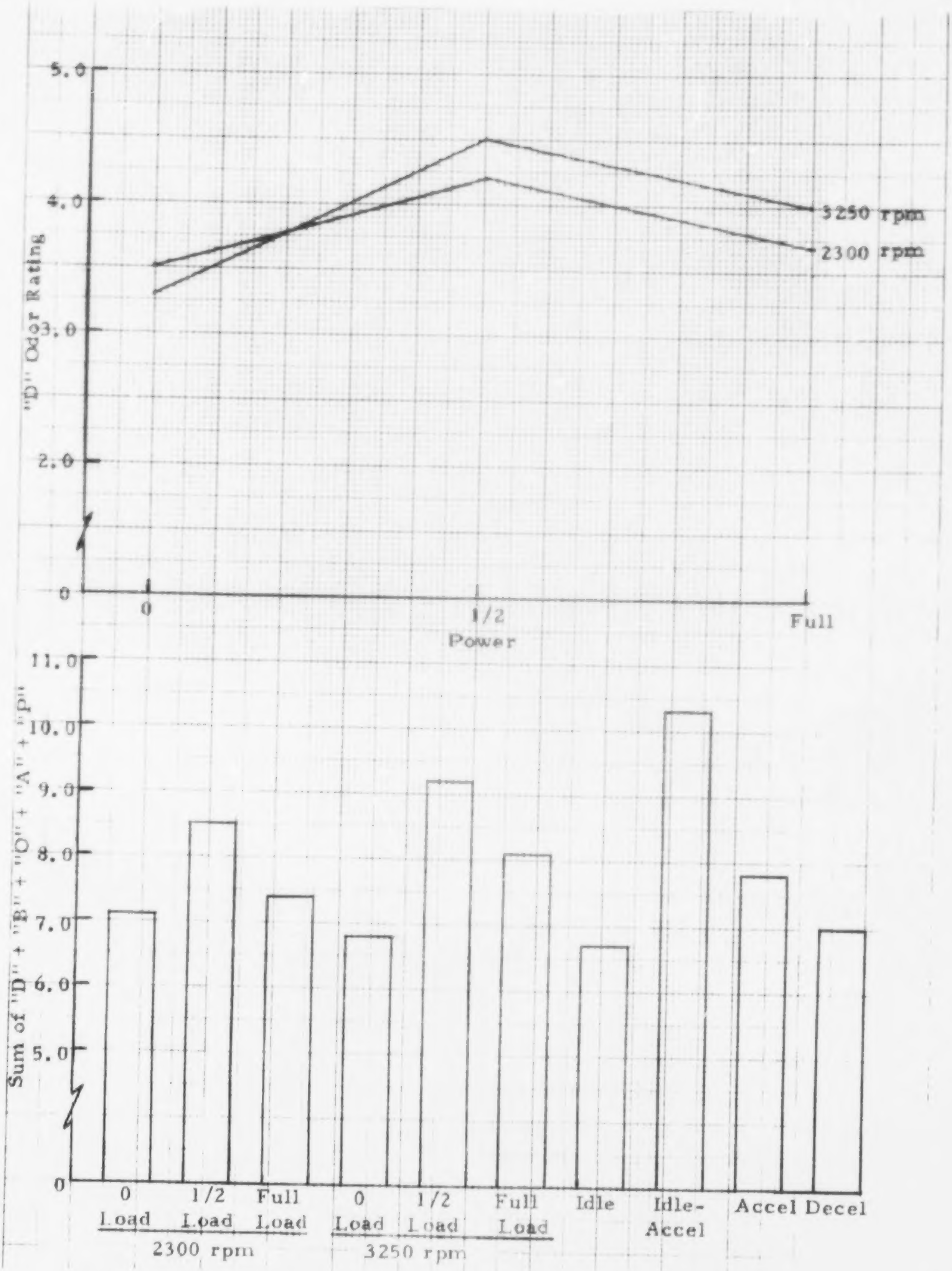

FIGURE 15. AVERAGE ODOR RATINGS FOR OPEL DIESEL LIGHT DUTY VEHICLE AT 100:1 DILUTION

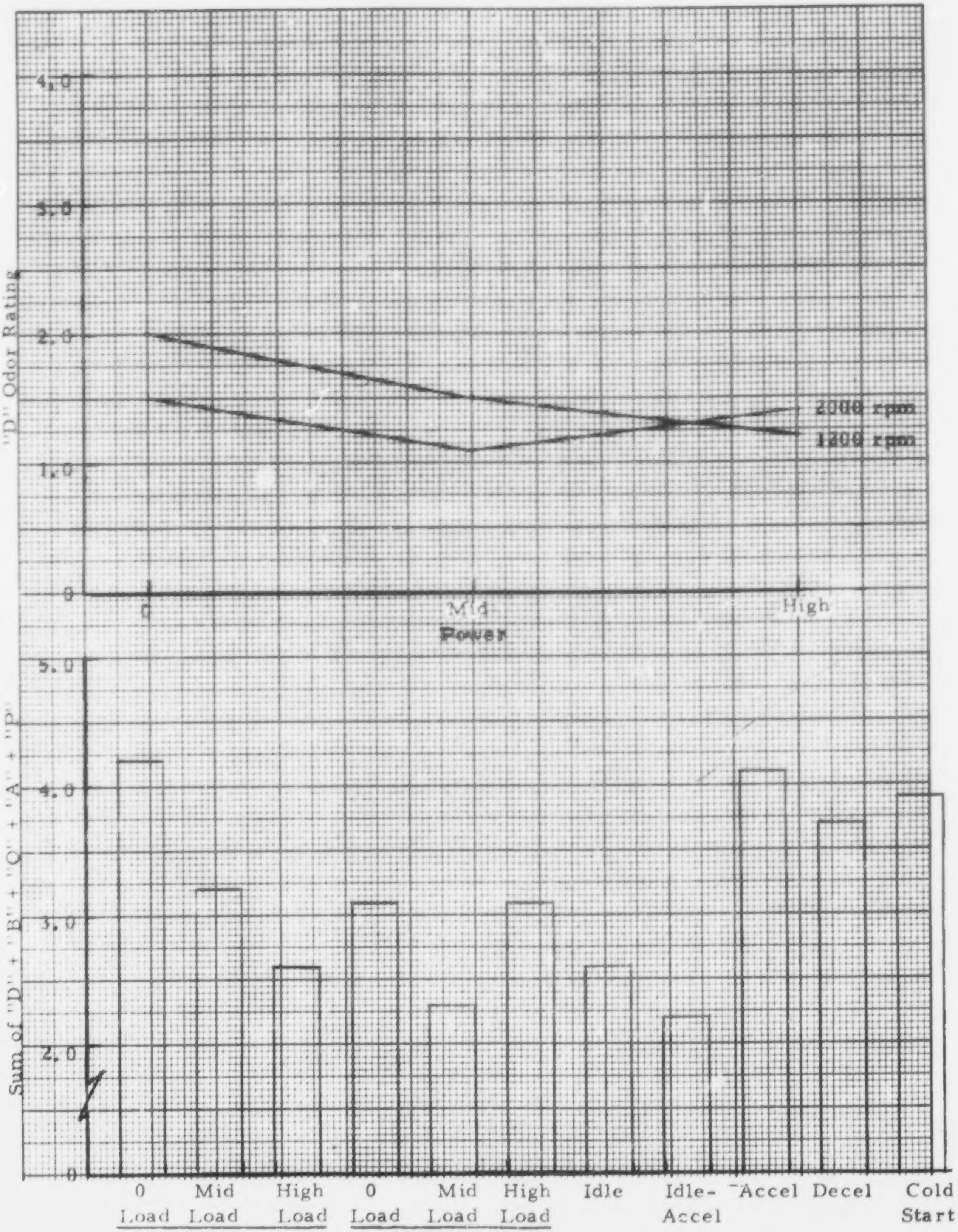

FIGURE 16. AVERAGE ODOR RATINGS FOR FORD LTD GASOLINE LIGHT DUTY VEHICLE AT 100:1 DILUTION

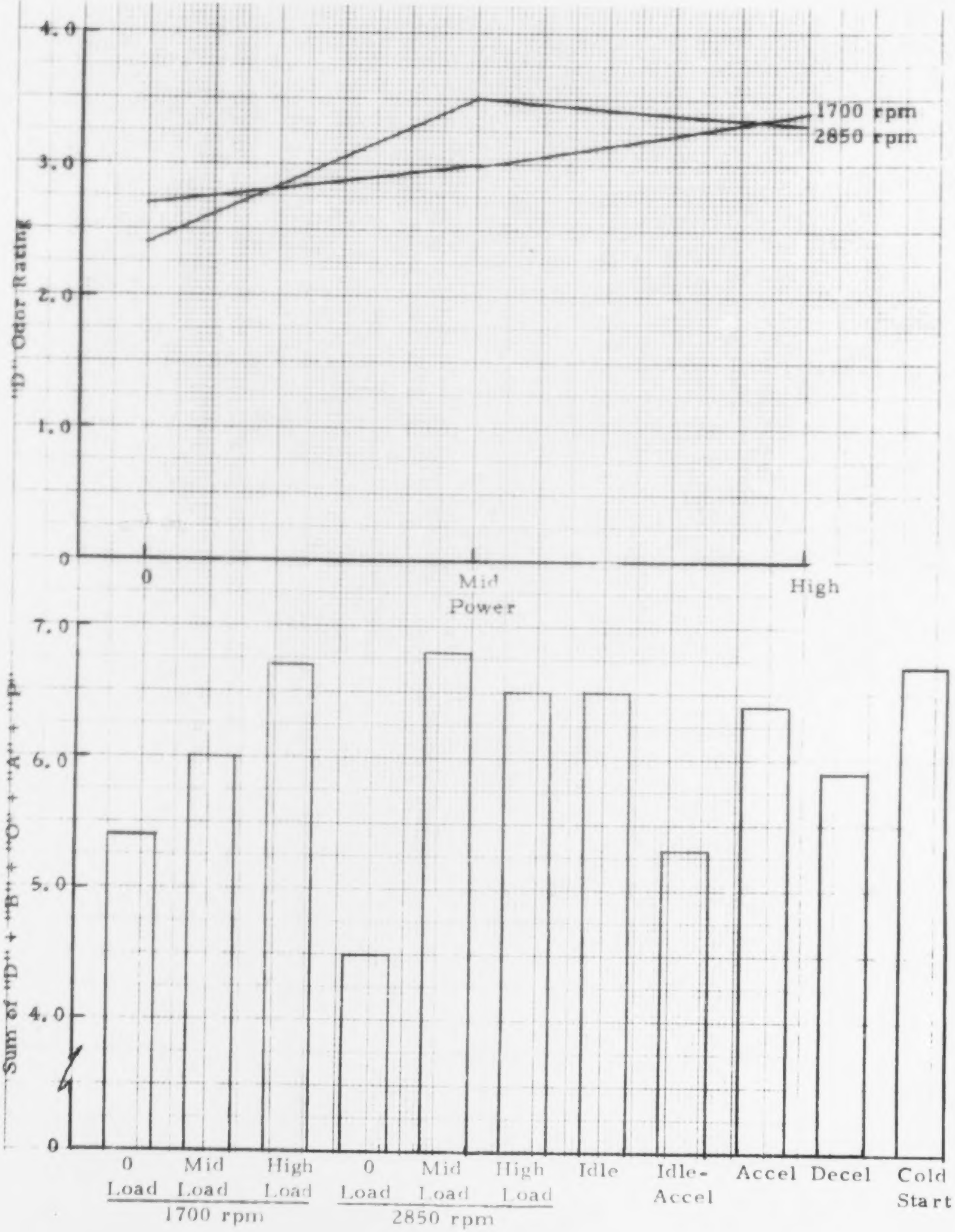

FIGURE 17. AVERAGE ODOR RATINGS FOR FORD CAPRI GASOLINE LIGHT DUTY VEHICLE AT 100:1 DILUTION

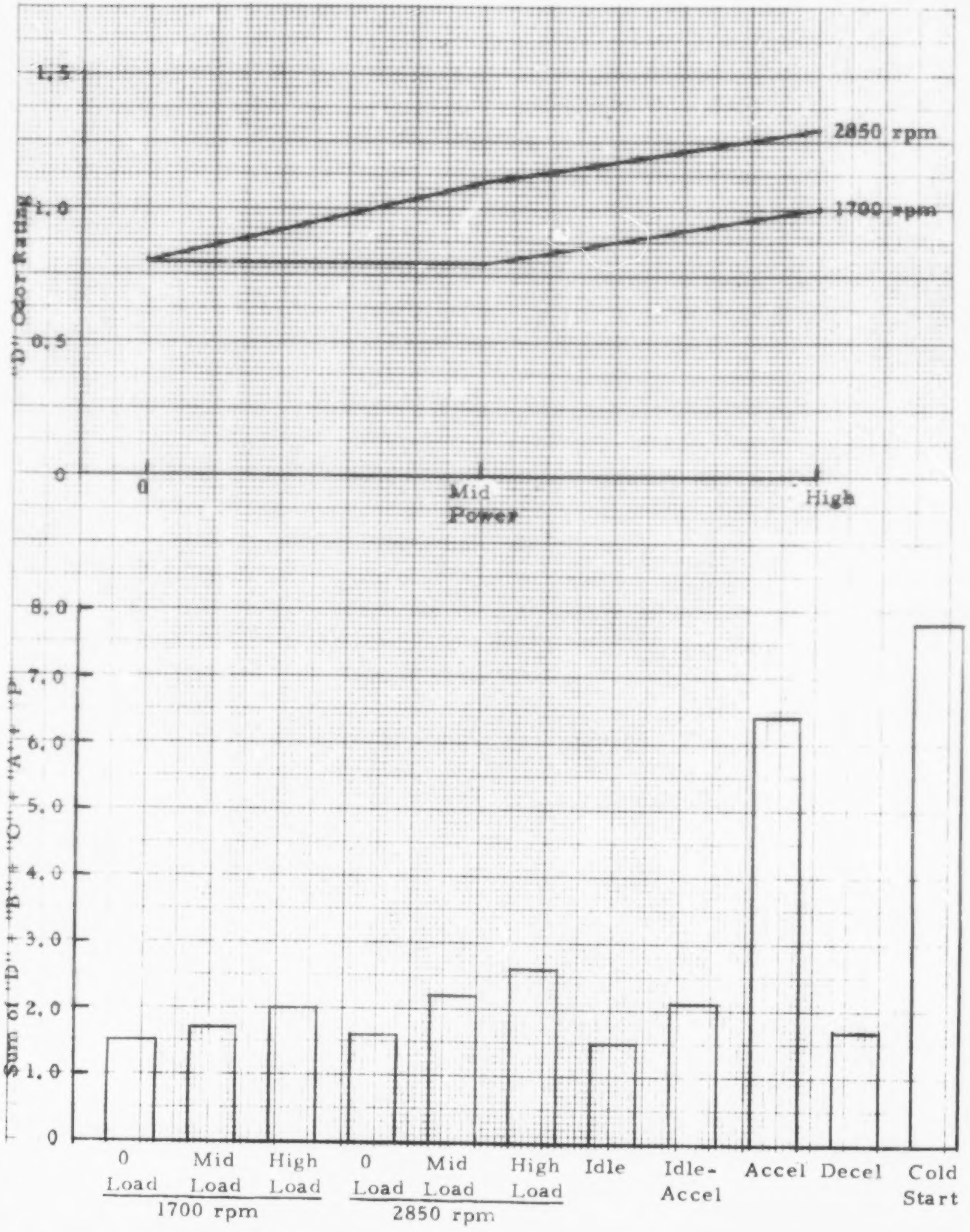

FIGURE 18. AVERAGE ODOR RATINGS FOR CAPRI PROCO LIGHT DUTY VEHICLE AT 100:1 DILUTION

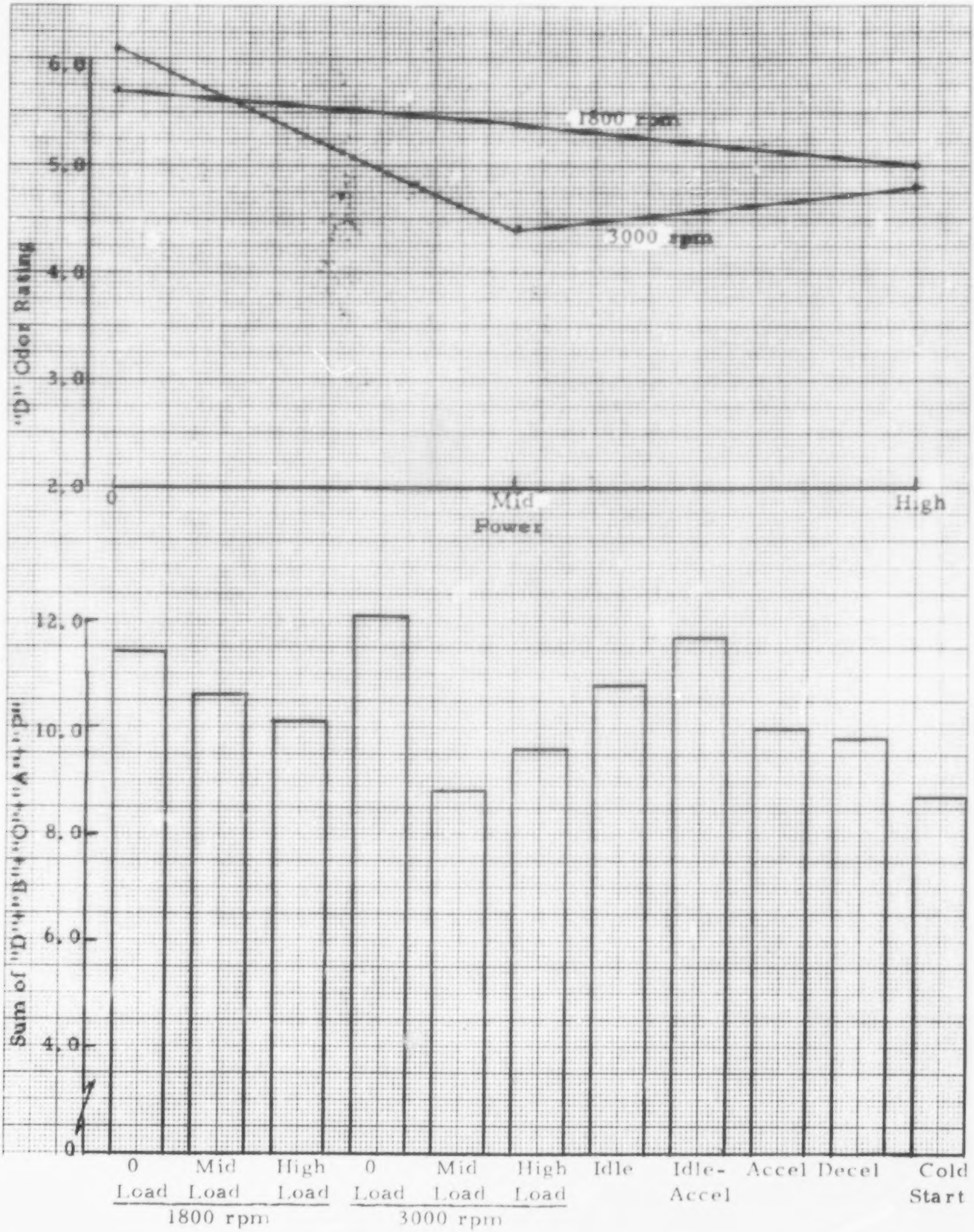

FIGURE 19. AVERAGE ODOR RATINGS FOR TEXACO TCCS POWERED PLYMOUTH CRICKET LIGHT DUTY VEHICLE AT 100:1 DILUTION - Diesel Fuel

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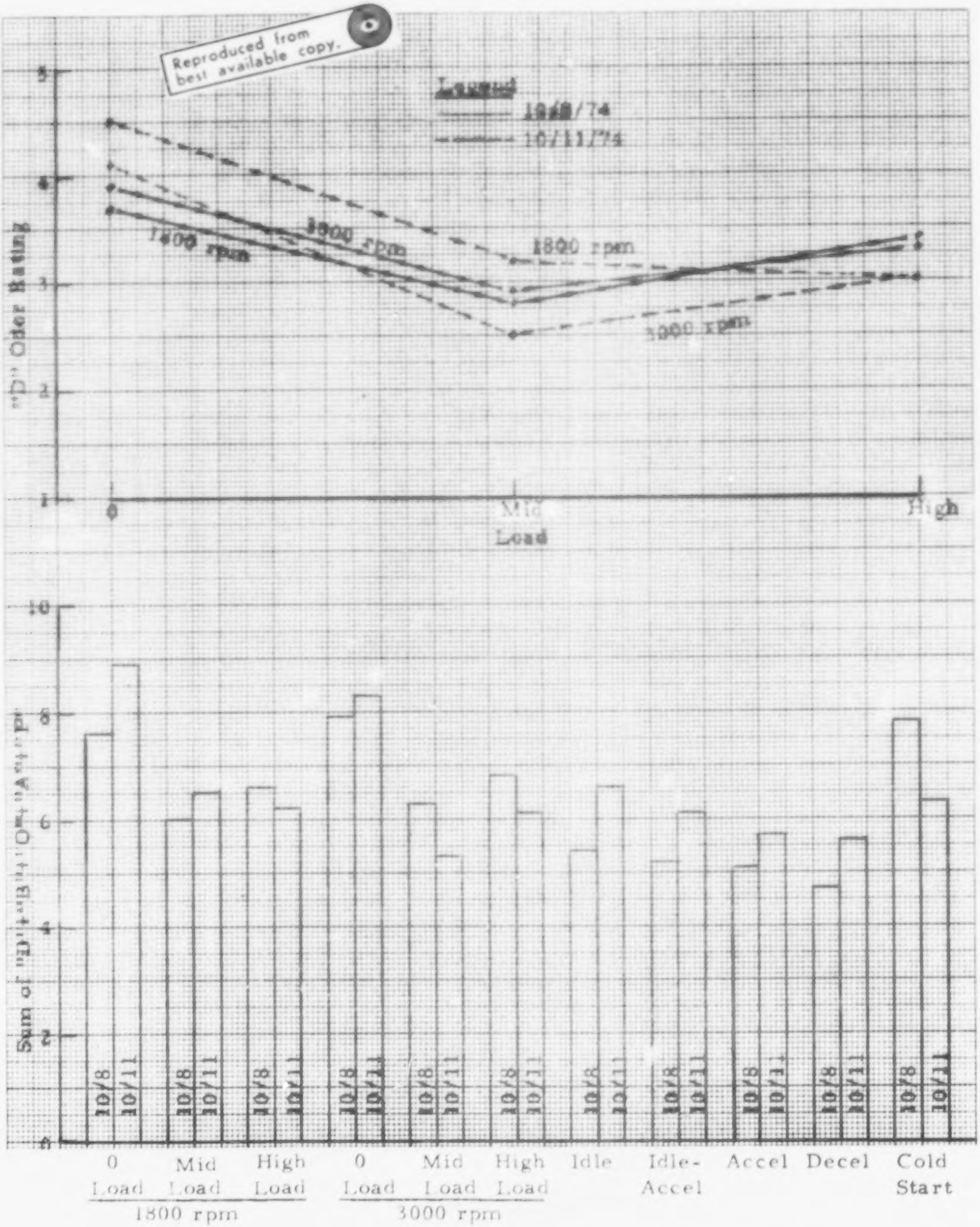

FIGURE 20. AVERAGE ODOR RATINGS FOR TEXACO TCCS POWERED PLYMOUTH CRICKET LIGHT DUTY VEHICLE AT 100:1 DILUTION - Gasoline Fuel

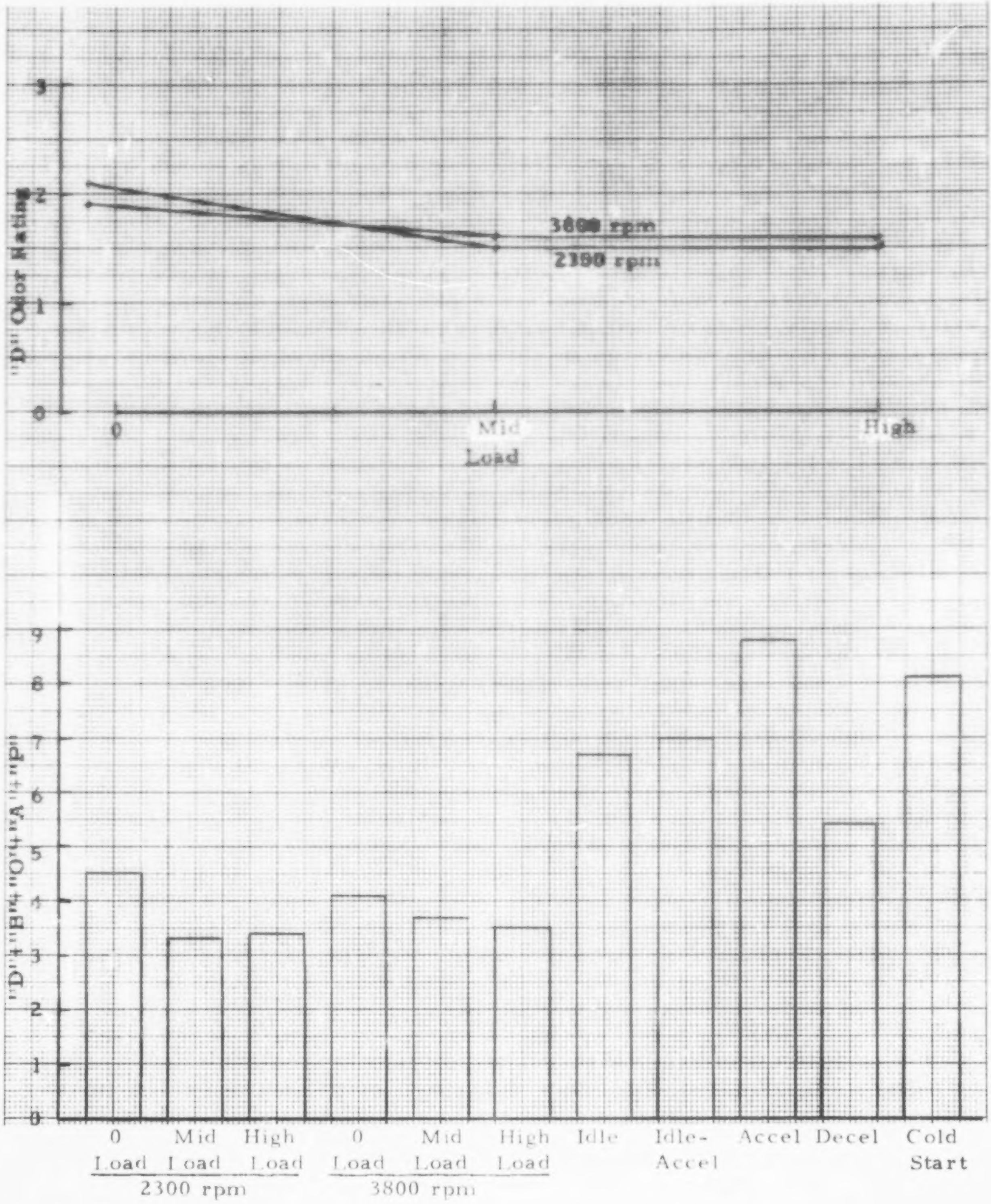

FIGURE 21. AVERAGE ODOR RATINGS FOR HONDA CVCC CIVIC LIGHT DUTY VEHICLE AT 100:1 DILUTION

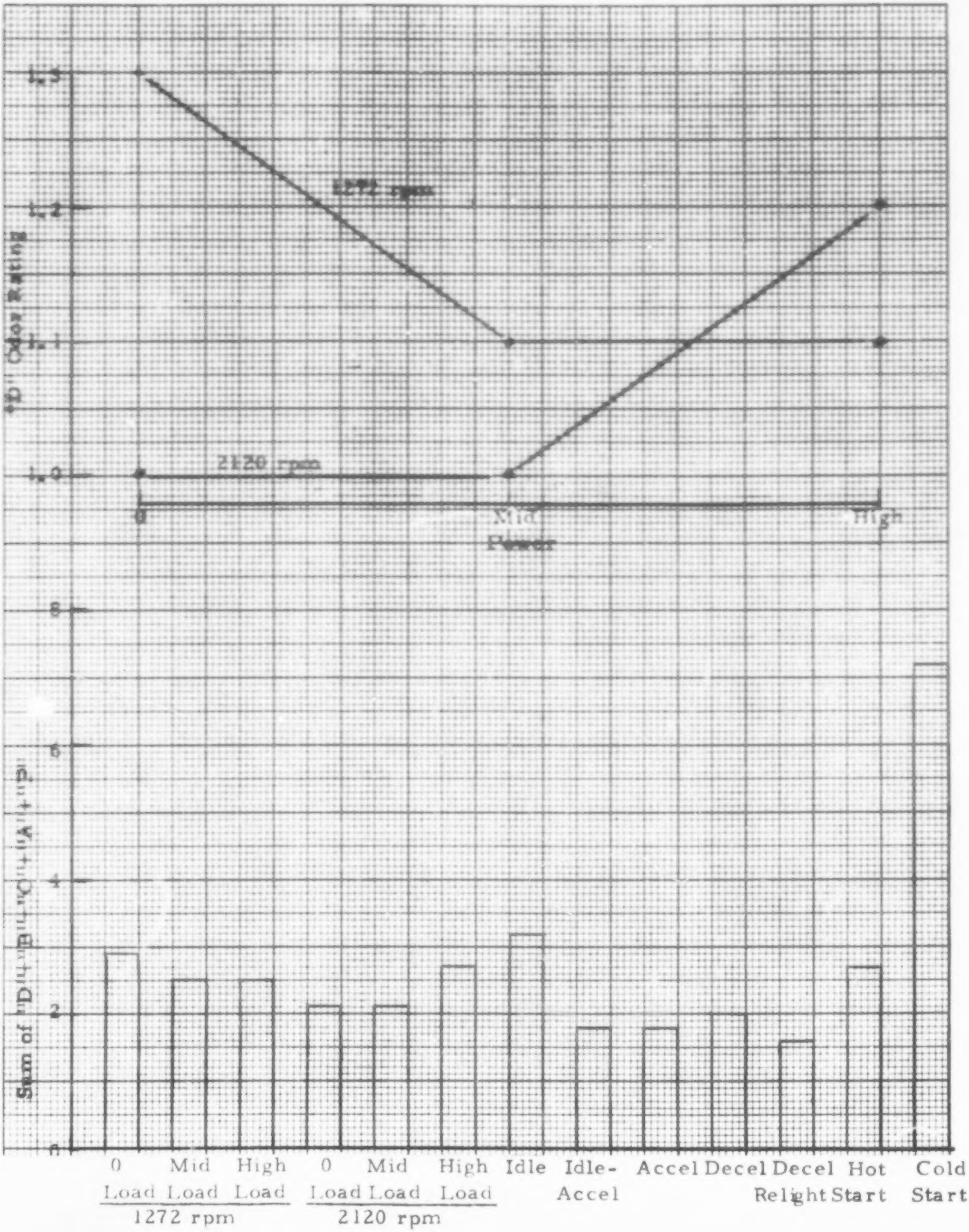

FIGURE 22. AVERAGE ODOR RATINGS FOR CHRYSLER GAS TURBINE SATELLITE LIGHT DUTY VEHICLE AT 100:1 DILUTION

checks during the remainder of the test program. On October 11, 1974, the second odor day was run without incident and is different from the first day by whatever timing advance the engine may have had on October 8, 1974, the first odor day. The timing was not checked on October 8, 1974 or on October 10, 1974 before distributor removal.

All tests which were run after October 10, 1974, including all diesel fueled odor and related chemistry and the 13-mode tests (both gasoline and diesel fuel) were with the repaired distributor and at specified timing. Prior to October 8, 1974, the noise tests were made. Prior to that, smoke tests on the 1975 FTP were run. The initial test series were made at specified timing. No problems in starting or restarting were noticed during any of the 1975 FTP operation for gaseous or smoke with either fuel. When changing over from gasoline to diesel during the noise tests, some difficulty was found in restarting the hot engine. After a brief cool-down, the engine restarted with no difficulty. Accordingly, it is likely that the distributor shaft began to "back-out" during the noise testing, some of which involves brief wide-open throttle accelerations. It was then probable that the first odor day, October 8, 1974, was at advanced timing. Accordingly, the odor results of October 8, 1974 are reported separately from October 11, 1974 and not averaged as with the other cars except the Nissan.

The graph of "D" intensity against power on Figure 20 illustrates the lack of an overall consistent effect of the probable advanced timing on October 8, 1974 versus October 11, 1974 standard timing. At no load, the advanced timing gave lower "D" ratings. At high load, the opposite was true though the difference is so slight as to make it within the day to day test repeatability. At mid power, the October 8, 1974 data was bracketed by the October 11, 1974 ratings. Overall, the differences in observed "D" ratings during the steady state speed and loads were slight and quite possibly within the test accuracy.

The Ford LTD and Honda CVCC showed a fourth characteristic of slightly decreasing odor with power. The Chrysler gas turbine data, average of three separate odor measurement tests (days) is depicted on Figure 22. The effect of load was most pronounced between no load and mid load at 1272 rpm, and between mid load and high load at 2120 rpm. These rpms are that of the power turbine and not the basic gas generator which operated over a much narrower speed range. The important finding was that at normal steady state speeds and loads expected to be encountered by this vehicle, the observed odor was "D"-1.3 or less. The data graphed in the top of Figure 22 ranges from "D"-1 to "D"-1.3, a very slight odor level and a very narrow odor range of 0.3 "D" units. Accordingly, it is difficult to relate these findings to operating data, etc., the conclusion being that the steady state odor, diluted to 100:1, was quite low. In the case of the Ford LTD and the Chrysler gas turbine, however, the loading relative to that possible from the engine was less than the other six lower power-to-weight ratio vehicles.

The important point of the graphs on Figures 12-22 is that odor is not necessarily a predicatble function of power. The commonly found minimum odor on some large HD engines at mid-power did not hold true for the passenger car diesels as these data indicate. This means that to quantify or characterize the odor from diesel or gasoline powered vehicles will likely require a multi-modal schedule of more than one or two test points.

The lower half of Figures 12 through 22 depicts the sum of the "D"+"B"+"O"+"A"+"P" average ratings for each of the ten conditions for each car as given on Table 12. This approach gives essentially equal weight to the "D" overall intensity and to the four quality ratings combined and is used for discussion purposes only. The effect of load, or lack of effect, may be seen in this summary representation for each engine speed in the first six bars. Note in Figure 12, the Nissan winter (W) and summer (S) results are shown side by side. The summer position had the effect of decreasing the odor at 3000 rpm, some at half load and more at full load. The winter position meant the intake air was being preheated by drawing it from a sheet metal "stove" arrangement around the exhaust manifold. The summer position ducted air from the conventional air cleaner air horn under hood location to the left of the radiator. The heated air at higher speed and load meant less oxygen (less air density) and possibly poorer combustion. At 1800 rpm, the effect of the switch on the Nissan was opposite, but not considered substantially different.

Of importance on Figure 12 and the others in this series was the substantially higher odor levels measured during certain of the transients. For the Nissan it was, based on the summer position which is the most important set of Nissan data, the accel and decel. They were substantially higher than all other modes. In the case of the Mercedes 220D (Figure 13) all three transients were higher overall than any steady state except 3000 rpm full load. The no load 1800 and 3000 rpm tests with the Peugeot (Figure 14) rated as high as the accel and these three conditions would be of greatest concern along with idle-accel, decel, and full load 3000 rpm runs.

The idle-accel in Figure 15 for the Opel diesel is the condition that produced highest odor. Surprisingly, the two half-load conditions were next in importance. The four gasoline cars continued to show the importance of one or more transients as far as producing exhaust odor is concerned. The LTD Ford, Figure 16, produced odor ratings during accel and decel on a par with the no load 1200 rpm. These were the three conditions of highest perceived odor. The standard Ford Capri accel, Figure 17, was about the same as a number of steady states such as high load at 1700 and mid and high load at 2850 rpm. The only odor level of consequence from the PROCO Capri, Figure 18, was the accel. Evidently the other modes were adequately controlled either by the stratified charge combustion system or by the oxidation catalyst in the exhaust.

From Figure 19, the idle-accel of the Texaco TCCS (diesel fueled) car was the highest of all three transients and was next in severity to the no load, 3000 rpm condition. This same engine and car, operating on gasoline and depicted in Figure 20, resulted in transient odor levels on a par with the mid and high power steady states but definitely below the two no load conditions. The idle and three transient conditions were, by the bar chart at the bottom of Figure 20, consistently lower, though slightly, on October 8, 1974. Cold start results showed the opposite trend.

The transient conditions definitely produced the highest odor from the Honda CVCC car. The accel was about twice the overall "D"+"B"+"O"+"A"+"P" rating of the six steady states. Idle and the idle-accel was about 50 percent greater than the six steady states. For reference, the six steady states produced "D" ratings of 1.5 to 2, a slight but noticeable odor level.

The four transients tested with the Chrysler gas turbine were all even lower in odor than the six steady states previously discussed and indicated as very slight, i.e., "D" of 1 to 1.3 intensity. The idle was the highest odor level of all conditions and was just slightly higher than the no load intermediate speed, high load high speed and hot start. The cold start mode was the condition found to produce odor of an appreciable level.

Cold start ratings are depicted on Figures 16 through 22 for those cars thus tested. In general, the cold start odor ratings were among the highest, if not the highest, of any of the ratings given a particular vehicle. This is particularly true for the LTD (Figure 16), the standard Capri (Figure 17), the PROCO (Figure 18) where the cold start equalled the only high odor found, the TCCS running on gasoline (Figure 20) and the Honda CVCC (Figure 21). The cold start was especially critical to the Chrysler gas turbine in that it was the only appreciable odor making condition of an otherwise low odor vehicle. The gas turbine cold start had a "D"+"B"+"O"+"A"+"P" of 6.7 compared to a rough average of 2.3, almost triple. The "D" intensity jumped from a nominal "D"-1 at the twelve operating conditions to "D"-3.7 during cold start.

Even with 100:1 dilution of the gas turbine exhaust, an already highly diluted engine exhaust, the odor was easily recognized and evaluated. In this regard, the cold start, and to a much lesser extent the idle, were the two most noticeable conditions. Yet, both of these conditions may occur under circumstances unfavorable to dilution of the odor. This is the cause of concern regarding the gas turbine engine since, unless it is moving, its high exhaust rate even during start and idle can rapidly envelope a closed or semi-open parking area, garage or carport. The consequence of several such engines in a congested area with limited dilution capability should be further considered. One first step may be to determine the reasonable minimum dilution that occurs in the vicinity of such a vehicle under a variety of driving situations.

From the Table 12 data and Figures 12 through 22, some additional discussion is justified. First, the Mercedes 220D tested in this project was much lower in odor levels than the vehicle tested in 1971(1, 3). A comparison is shown in Table 13. Except for idle-accel, and to lesser extent idle and full load high speed, greatly lower odor was observed during the 1974 test program than in 1971.

TABLE 13. COMPARISON OF MERCEDES 220D RESULTS TO PREVIOUSLY REPORTED ODOR RATINGS(1, 3)

			Average Odor Panel Rating				
Load	Engine rpm	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
0	1800	1974	2.6	1.0	0.9	0.5	0.4
	2500	1971	6.0	2.0	1.4	1.1	1.5
Half	1800	1974	2.6	1.0	0.9	0.6	0.3
	2500	1971	3.8	1.1	1.0	0.8	0.7
Full	1800	1974	3.4	1.1	0.9	0.8	0.8
	2500	1971	4.0	1.2	1.0	0.9	0.8
0	3000	1974	2.6	1.0	0.9	0.5	0.4
	4200	1971	4.4	1.3	1.1	1.0	1.0
Half	3000	1974	3.1	1.1	0.9	0.6	0.6
	4200	1971	6.1	2.1	1.3	1.1	1.6
Full	3000	1974	3.9	1.2	1.0	0.8	0.9
	42000	1971	5.5	1.9	1.3	1.1	1.3
	Idle	1974	3.1	1.0	0.9	0.8	0.6
		1971	3.9	1.1	1.0	1.0	0.8
	Idle-Acceleration	1974	4.0	1.4	1.0	0.8	0.9
		1971	4.5	1.4	1.0	1.0	0.9
	Acceleration	1974	3.4	1.1	1.0	0.7	0.9
		1971	5.2	1.8	1.2	1.0	1.2
	Deceleration	1974	3.7	1.1	1.0	0.9	0.8
		1971	6.8	2.1	1.7	1.2	1.8

A possible major reason may be the improvements made to the Mercedes 220 fuel injection system. Another reason for the substantial difference in the six steady state conditions may be the difference in engine speeds employed. However, this seems of little consequence in this particular case since odor was less at both speeds and the odor at 3000 rpm (1974) versus odor at 2500 rpm (1971) continues to show the important difference. In any event, the 1974 odor testing results of the Mercedes 220D car are quite encouraging and show that this specific diesel car engine does have much lower odor than that found in 1971.

The Texaco TCCS powered Cricket, capable of operating equally well on either gasoline or diesel fuel, permitted a direct comparison of the odor ratings. Figure 23 shows both gasoline and diesel odor data for the Texaco TCCS. The gasoline data is the October 11, 1974 ratings since they were obtained at known, standard, spark timing and considered the most reliable of the two odor tests with gasoline. The "D" intensity shown at the top of Figure 23 is much higher for the diesel than the gasoline. These differences in "D" level were consistent at both speeds regardless of load. The diesel fueled TCCS was also consistently higher in odor, as shown by the bar chart also on Figure 23, during the idle and three transients. Only during the cold start were the ratings fairly close together. As a general comparison, there was a two "D" rating difference between diesel, range of "D"-5.5 to 6.0, and gasoline, range of "D"-3.5 to 4.0. These differences were typically greater than "D"-2 during the idle and transients. A more thorough comparison may be made by subtracting the gasoline odor ratings (October 11, 1974) from the diesel TCCS ratings on Table 12.

In comparing the odor from vehicle to vehicle, it is necessary to either consider each mode, which may be done by the bar charts and Table 12, or to merely average the ten conditions together directly. This then gives 60 percent weight to the speed and load conditions, ten percent to the idle, and 30 percent to the transients. Probably idle should get 20 percent weight since it usually accounts for this much operation in urban-suburban driving. The 30 percent weight factor for transients could easily be argued higher but it would be just as arbitrary as using, for purposes of this ranking, equal weighting. To make this comparison simple, it is based only on the "D" intensity rating. This is probably best since the panel experienced difficulty using the odor quality standards with three of the gasoline cars. Table 14 lists these averages and is an attempt at a rough comparison of the exhaust odor from all cars tested. The cars are grouped as diesel and gasoline. There is little doubt that the Peugeot and the Texaco TCCS powered Cricket, both operating on diesel fuel, had much stronger odor intensities than any of the other cars and that they were consistently high regardless of operating mode investigated. The diesel fueled TCCS engine had very much the same odor marks as the Peugeot 504D.

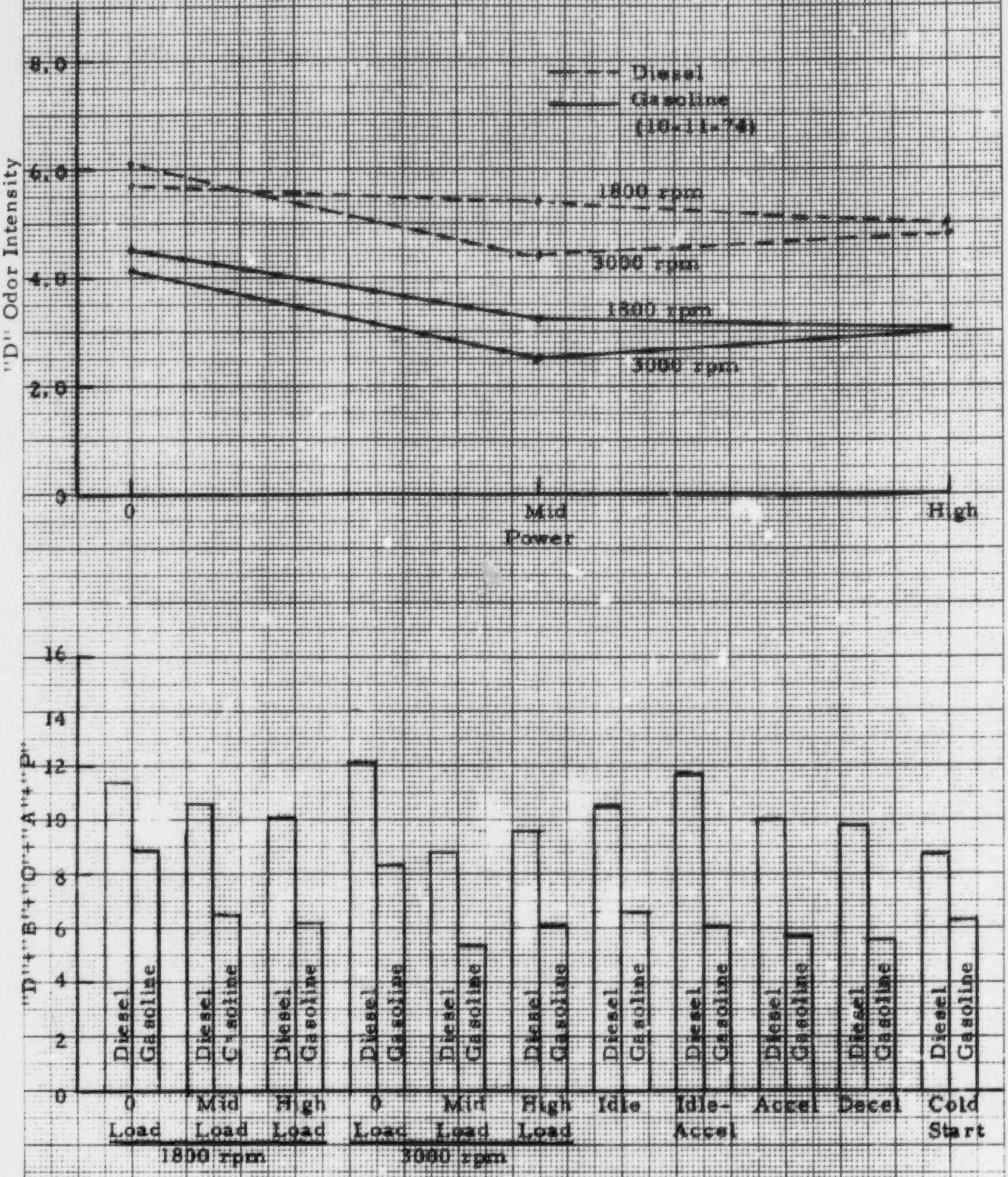

FIGURE 23. COMPARISON OF GASOLINE AND DIESEL FUELED TEXACO TCCS ODOR RATINGS

The "D" ratings may be compared from Table 12 to give the following:

Speed	Load	"D" Odor Rating		Difference
		Peugeot 504D	TCCS Diesel	
Intermediate	no	6.0	5.7	-1.3
	mid	4.1	5.4	+1.3
	high	4.7	5.0	+0.3
High	no	6.0	6.1	+0.1
	mid	4.7	4.4	-0.3
	high	5.6	4.8	-0.8
Idle		4.8	5.3	+0.5
Idle-Accel		5.6	5.7	+0.1
Accel		6.0	5.0	-1.0
Decel		5.5	4.9	-0.6

The overall average difference from Table 14 is 0.1 "D" level, the TCCS being essentially equivalent in odor intensity as the Peugeot diesel.

TABLE 14. ROUGH COMPARISON OF VEHICLE "D" ODOR RATINGS

Type Fuel	Car Evaluated		Six Steady States	Idle	Three Trans.	All Ten Conditions
Diesel	Nissan-Datsun	W	3.4	2.9	4.7	3.8
		S	3.2	2.7	4.6	3.6
	Mercedes 220D		3.0	3.1	3.7	3.2
	Peugeot 504D		5.2	4.8	5.7	5.3
	Opel Rekord		3.9	3.3	4.1	3.9
	TCCS Cricket		5.2	5.3	5.2	5.2
	Chrys. Gas Turbine		1.1	1.5	0.8	1.0
Gasoline	Ford LTD		1.5	1.2	1.5	1.5
	Standard Capri		3.0	3.3	2.9	3.0
	PROCO Capri		1.0	0.7	1.6	1.1
	TCCS Cricket					
	10/8/74		3.3	2.7	2.4	3.0
	10/11/74		3.4	3.1	2.8	3.2
	Honda CVCC		1.7	3.2	3.5	2.4

To give some idea of the possible difference in odorant concentration, the expression used to develop the odor Q/I kit may be used to compare the Peugeot to the Mercedes 220D, both diesel powered. The Mercedes was the lowest diesel of the group tested and is the other diesel car, beside the Peugeot, currently marketed in the U. S.

$$\text{Odorant Concentration} = 2^n$$

where n is the difference in "D" bottle
intensity ratings.

Raising 2 to the "D"-5.3 minus "D"-3.2 or $2^{2.1}$ equals 4.29. The "D"-5.3 and "D"-3.2 are from Table 14 for all ten conditions, Peugeot and Mercedes. Thus, if the exhaust odorants in the 100:1 diluted exhaust follow this relationship, the Peugeot is over four times the odorant concentration as the Mercedes. This means to reduce the perceived odor level of the Peugeot to that of the Mercedes, for example, will require a substantial reduction in odorant concentration since perceived odor is related to odorant strength by a power function not specifically defined for diesel exhaust.

It is not technically correct to compare the gasoline results to that of the diesel fueled engines even though the same odor measurement system was employed. This was the first time the EPA Q/I diesel odor kit has ever been used with a gasoline fueled Otto or stratified charge type cycle. The experiments, especially the first series of tests, were most difficult and frustrating to the panel, trained to evaluate dilute diesel exhaust samples. The odor from the gasoline engine, with the exception of the Texaco TCCS, was generally not as strong and had a different quality not at all like that of the diesel engines previously evaluated. Of all the ratings made, most importance was given to the "D" intensity rating.

Even though there was an odor to the exhaust, it was so unlike diesel exhaust that the "D" values are somewhat suspect. Except for the standard Capri and the Texaco TCCS, the gasoline cars all had odor levels at "D"-2 or less (Ford LTD and Honda CVCC, except transients) and "D"-1.3 or less (PROCO Capri) with the exception of PROCO accel. For conventional odor measurement, "D"-2 is considered a light odor and is the lowest level for which reliable ratings by the odor panel are possible. For average ratings below "D"-2, more individual ratings of "D"-1 and "D"-1.5 are involved. As odor ratings approach 1, the reliability of the rating decreases rapidly.

Below "D"-1, the odor ratings are merely guesses since the threshold of detection is encountered and the Q/I kit is inappropriate. Average values less than "D"-1, for most of the PROCO runs, are considered to indicate the presence of an odor and nothing more. The

Ford LTD runs gave "D"-1 to "D"-2 and their reliability and precision are somewhat of concern.

Of the gasoline cars evaluated, the standard Capri "D" values were the highest overall, being in the "D"-2.2 to "D"-3.5 range. The three transients with the Honda CVCC resulted in "D" odor ratings of "D"-2.6 to 4.4, slight to moderately strong levels. Although the Capri ratings were in the same range, though slightly lower than the Mercedes 220D, the comparison should not be carried much further. The gross difference in odor character between the gasoline and diesel cars precludes any direct comparisons. The major conclusion of the odor testing with the gasoline cars is that it can be done if conditions are preset very carefully, and ratings can be made with difficulty by the same basic procedure and method of expression used with diesels. A relative comparison within the group of diesels and within the group of gasoline cars is the extent to which the results should technically be used at this time.

There are two reports(15, 16) and a paper(17) which summarize the results of public opinion surveys made of diesel exhaust odor. In general, these studies show increasing public objectionability with increased odor intensity. Although beyond the scope of this project, it would be interesting to consider the specific objectionability of the cars tested in this project. There is little doubt that all diesels tested would be easily noticed by the general public. The specific Peugeot, as tested, would be much more objectionable than the other three diesels using the scale developed for city bus exhaust odor. It would be unfortunate if widespread use of diesels happened to have an odor intensity as high as the Mercedes. The goal must be no more noticeable than the gasoline engine. Though debatable, a "D" level of less than "D"-2 seems appropriate. None of the diesels in this project have demonstrated this type of exhaust odor but some large size HD diesels have approached it. With care and attention to detail, a properly optimized and designed passenger car diesel should possess an overall "D" odor level of less than "D"-2.

For additional odor panel measurement data, Tables C-1 through C-34 are provided. For each car, these tables are used to first summarize the two days of work, three in the case of the Chrysler gas turbine, and then tabulate the individual run results for each day. The Appendix C tables are in the same order as the cars were tested and summarized on Table 12 in the text. These detailed results are provided for further study and evaluation of run-to-run repeatability and day-to-day agreement of not only the intensity but quality ratings.

2. Gaseous Emissions

Simultaneous with the odor ratings, a number of gaseous emissions were analyzed. Table 15 is a complete summary of these instrumental-wet chemical ratings for the seven steady-states evaluated. Also listed on Table 15 are the DOAS odor instrument values. This data, from raw exhaust, correlates well with the 13-mode raw exhaust concentrations although different speeds were involved. It is interesting to note the behavior of HC and oxygenates versus load and to compare this with odor intensity in Figures 12-22.

In the case of the Nissan, Mercedes, Capri Standard and PROCO, the increase in HC was either incidental or did not correlate well with the slight rise in odor experienced. Only the standard Capri, at high speed, HC correlated with "D" odor. Yet the odor was not gasoline odor. Oxygenates for the same four cars shows such mixed behavior with load as to preclude any generalization. It is interesting to note the substantially higher formaldehyde and aliphatic aldehydes from the standard Capri relative to the PROCO Capri and the absence of acrolein in the PROCO exhaust. Perhaps the abnormally high oxygenates from the standard Capri were in part responsible for its abnormally high odor.

Similar analyses for the Peugeot, whose odor was minimum at half load, indicates HC to have some degree of correlation. The oxygenates, however, show mixed results relative to odor trends. The reason the Peugeot odor and HC seem to "track" may be because the HC are grossly higher from the Peugeot relative to the Mercedes and Nissan. In prior projects, HC has been considered a good predictor of odor until the HC is reduced to about 100 ppm. Below this level, other exhaust odorants apparently are more important.

The Opel car had peak odor at half load. HC from Table 15 definitely do not agree trendwise. Neither do acrolein, formaldehyde, or aldehydes correlate consistently to odor. The Ford LTD and Honda CVCC both experienced a slight decrease in odor as load increased. Only the high speed LTD HC data are consistent with the decrease in odor of these two cars. Of the oxygenate data, the Ford LTD high speed aldehyde values decreased as power increased. At intermediate speed, the Honda CVCC formaldehyde and aldehyde ratings uniformly decreased with the opposite trend noticed at high speed. The diesel fueled Texaco TCCS decrease in odor with power increase correlated with HC at high speed but not intermediate speed. The three oxygenate values tended to track the "D" odor intensity but at high speed, like the HC results.

The gasoline powered TCCS results for both 10/8/74 and 10/11/74 are shown on Table 15 for comparison. The 10/11/74 results with the spark timing at known standard seemed to increase HC, CO and lower NO_x although under some conditions, such as 3000 rpm no load, the effect was negligible. Idle showed the opposite trend with HC and CO

TABLE 15. EXHAUST ANALYSES TAKEN SIMULTANEOUSLY WITH ODOR RATINGS DURING STEADY-STATE CONDITIONS*

Vehicle Condition	Exhaust Emission	Datsun		Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	TCCS Diesel	TCCS Gasoline		Honda CVCC	Chrysler Gas Turbine
		Winter	Summer								10/8/74	10/11/74		
Intermediate Speed, no load	HC, ppmC	68	83	76	1004	94	294	1052	21	2311	2037	2603	158	29
	CO, ppm	264	271	227	761	246	221	1.9%	3	937	461	534	4233	41
	NO-NDIR, ppm	57	66	66	34	59	101	65	118	-	-	-	139	-
	NO-CL, ppm	78	75	75	32	94	95	59	109	45	51	43	88	8
	NO_x-CL, ppm	97	96	83	53	115	99	62	110	50	57	48	93	9
	O_2, %	16.8	17.1	16.4	17.4	15.6	7.1	3.3	5.4	15.7	15.7	15.1	3.0	0.8
	CO_2, %	2.7	2.3	2.8	2.5	2.7	10.0	11.9	11.2	2.01	2.06	1.99	13.05	
	Acrolein, ppm	1.1	2.3	0.9	11.2	2.7	1.3	1.7	0	9.5	5.9	4.9	1.5	
	Formaldehyde, ppm	5.0	5.2	2.4	10.5	3.8	8.1	20.9	0.8	55.2	27.6	16.4	18.5	
	Aliph. Alde., ppm	11.0	9.1	9.6	36.0	10.6	21.9	60.5	9.5	121.1	49.5	34.6	36.2	
	TIA	1.5	1.4	1.6	2.2	1.7	1.6	1.9	0.7	2.5	1.9	1.7	1.4	
	LCA, μg/l	7	4	12	134	12	4	26	0	204.2	20.1	18.6	6.2	
	LCO, μg/l	3.5	2.8	4.1	16.0	5.1	4.4	8.3	0.6	29.9	8.4	5.3	3.2	
Intermediate Speed, mid load	HC, ppmC	103	67	77	339	114	318	1311	7	742	404	576	38	22
	CO, ppm	173	168	248	237	162	198	0.5%	4	136	29	35	1893	29
	NO-NDIR, ppm	365	333	340	221	288	821	654	288	-	-	-	602	-
	NO-CL, ppm	332	307	333	194	283	798	541	279	123	133	115	425	13
	NO_x-CL, ppm	344	317	338	208	290	602	559	273	127	140	122	441	14
	O_2, %	10.8	11.2	11.1	11.4	8.7	5.9	3.6	2.2	13.6	13.8	14.1	2.3	-
	CO_2, %	7.5	6.8	7.0	7.2	8.4	10.8	12.2	14.3	4.47	3.84	3.97	13.52	1.0
	Acrolein, ppm	0.8	1.8	0.7	2.9	1.5	0.9	3.7	0	6.1	1.3	1.4	0.9	
	Formaldehyde, ppm	3.5	5.0	3.4	10.7	3.3	14.6	21.9	1.0	31.5	14.5	12.2	8.6	
	Aliph. Alde., ppm	11.0	11.8	10.5	17.8	7.6	30.8	57.7	7.6	57.6	20.4	21.3	16.7	
	TIA	1.6	1.5	1.6	2.1	1.9	1.8	2.2	0.7	2.5	1.5	1.6	1.3	
	LCA, μg/l	9	6	13	112	25	5	41	0	180.0	5.6	6.0	5.9	
	LCO, μg/l	3.7	3.4	4.1	12.7	7.1	5.2	14.6	0.6	33.5	3.2	4.8	3.0	
Intermediate Speed, high load	HC, ppmC	115	107	81	391	140	220	1480	8	1182	181	244	105	18
	CO, ppm	2792	536	301	686	541	226	0.2%	0	92	76	25	2728	20
	NO-NDIR, ppm	384	417	438	249	293	1409	1707	668	-	-	-	1284	-
	NO-CL, ppm	380	400	412	223	306	1354	1413	643	240	255	227	1138	19
	NO_x-CL, ppm	380	400	417	223	310	1363	1467	644	247	275	238	1165	19
	O_2, %	1.3	2.6	6.3	4.4	3.2	5.4	3.5	2.9	12.0	11.2	11.2	2.8	-
	CO_2, %	14.4	13.7	10.9	12.5	13.2	11.3	12.3	13.4	5.77	5.61	5.76	13.18	1.2
	Acrolein, ppm	1.0	1.8	0.7	2.0	1.0	1.8	5.0	0	3.5	2.0	1.0	1.1	
	Formaldehyde, ppm	3.7	4.6	4.2	13.3	3.6	11.4	22.9	1.8	39.6	14.3	13.3	3.7	
	Aliph. Alde., ppm	9.4	7.7	9.4	20.2	7.8	31.3	66.4	9.0	64.9	28.1	22.3	13.8	
	TIA	1.7	1.6	1.7	2.1	1.9	1.8	2.2	0.5	2.4	1.5	1.4	1.2	
	LCA, μg/l	17	11	13	128	20	3	39	0	159.7	4.2	1.6	3.0	
	LCO, μg/l	4.8	4.3	5.0	15.7	7.9	6.3	17.9	0.4	26.3	2.9	2.5	1.6	
High Speed no load	HC, ppmC	60	75	57	952	98	523	144	9	1984	2339	2400	37	23
	CO, ppm	326	304	362	466	362	287	0.4%	4	834	212	165	508	23
	NO-NDIR, ppm	129	134	97	56	85	325	150	212	-	-	-	167	-
	NO-CL, ppm	138	136	103	53	106	305	119	203	60	52	48	125	15
	NO_x-CL, ppm	153	142	108	76	128	305	119	204	66	57	52	131	16
	O_2, %	15.7	16.0	15.5	16.7	14.9	7.2	1.3	4.8	16.0	15.0	15.3	2.6	1.1
	CO_2, %	3.2	3.2	3.5	3.0	3.4	9.8	14.2	11.8	2.52	2.70	2.79	13.4	
	Acrolein, ppm	0.8	2.3	0.9	5.0	3.1	1.1	1.6	0.1	9.7	5.6	3.6	0.7	
	Formaldehyde, ppm	4.2	5.8	3.7	11.9	3.5	6.5	19.7	2.2	44.2	15.0	14.8	3.8	
	Aliph. Alde., ppm	12.9	7.7	11.8	24.8	10.0	27.0	51.6	8.1	100.7	29.4	31.1	13.1	
	TIA	1.8	1.8	1.6	2.1	1.8	1.9	2.0	0.6	2.6	1.9	2.0	1.4	
	LCA, μg/l	26	17	10	153	10	6	24	0	194.8	20.1	23.4	4.0	
	LCO, μg/l	6.9	5.8	3.9	13.5	6.8	6.6	9.2	0.6	34.5	8.0	9.5	2.7	

TABLE 15 (Cont'd.) EXHAUST ANALYSES TAKEN SIMULTANEOUSLY WITH ODOR RATINGS DURING STEADY-STATE CONDITIONS*

Vehicle Condition	Exhaust Emission	Datsun		Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	TCCS Diesel	TCCS Gasoline		Honda CVCC	Chrysler Gas Turbine
		Winter	Summer								10/8/74	10/11/74		
High Speed, mid load	HC, ppmC	52	33	55	412	172	102	1075	5	331	176	163	33	26
	CO, ppm	133	135	252	549	242	341	0.4%	6	120	47	13	419	11
	NO-NDIR, ppm	425	407	412	247	351	656	2473	871	-	-	-	1368	-
	NO-CL, ppm	427	400	388	302	336	642	1867	831	309	317	258	963	39
	NO_x-CL, ppm	427	402	391	312	344	642	1883	831	317	333	272	987	39
	O_2, %	10.0	9.9	10.3	10.5	9.0	2.9	1.2	1.9	12.6	11.5	12.3	2.7	1.4
	CO_2, %	8.1	7.5	7.8	8.1	8.2	13.5	14.0	14.4	5.35	5.42	5.34	13.54	
	Acrolein, ppm	0.4	1.7	0.7	5.4	2.1	0.8	4.4	0	4.3	3.3	1.0	2.0	
	Formaldehyde, ppm	2.9	5.0	4.4	15.4	3.5	5.7	25.0	1.7	50.0	13.9	13.5	9.3	
	Aliph. Alde., ppm	8.3	9.0	11.3	20.0	8.9	21.1	62.6	7.3	71.1	21.4	24.5	14.5	
	TIA	1.6	1.5	1.6	2.1	2.0	1.4	2.2	0.5	2.3	1.5	1.4	1.4	
	LCA, μg/l	11	5	10	106	50	3	36	0	139.4	4.8	2.5	2.5	
	LCO, μg/l	3.7	3.5	3.8	13.6	11.4	4.9	14.5	0.4	21.0	3.4	2.6	3.0	
High Speed, high load	HC, ppmC	481	125	92	562	130	63	1883	20	649	36	43	60	52
	CO, ppm	11,555	2261	273	1099	975	596	3.1	8	75	42	40	1607	10
	NO-NDIR, ppm	398	428	565	315	332	696	1944	1396	-	-	-	3011	-
	NO-CL, ppm	378	423	534	304	338	679	1690	1317	746	697	618	2379	67
	NO_x-CL, ppm	382	423	534	306	340	679	1713	1323	765	743	705	2455	68
	O_2, %	0.4	1.5	5.1	3.4	2.3	1.8	0.4	4.7	9.1	8.3	8.3	1.8	-
	CO_2, %	14.5	14.0	11.7	13.1	13.8	14.1	13.7	11.7	8.10	8.10	8.10	13.92	1.7
	Acrolein, ppm	0.3	1.7	0.8	2.6	1.0	0.9	2.4	0	5.5	2.4	1.8	3.0	
	Formaldehyde, ppm	3.3	3.3	4.2	10.0	4.3	5.9	25.2	1.0	62.7	14.5	14.9	12.4	
	Aliph. Alde., ppm	10.5	6.3	9.8	19.7	7.6	18.7	58.3	9.5	70.9	23.1	23.6	20.7	
	TIA	1.7	1.6	1.9	2.5	2.1	1.6	2.1	1.1	2.2	1.3	1.2	1.3	
	LCA, μg/l	14	9	24	194	37	4	53	0	130.9	2.6	2.6	3.7	
	LCO, μg/l	5.0	3.9	8.1	27.5	13.0	4.0	14.8	1.3	18.9	2.2	1.8	2.6	
Idle Speed, no load	HC, ppmC	59	39	116	332	69	116	2107	51	1037	845	1781	632	35
	CO, ppm	169	151	254	592	187	133	4.4%	5	767	17	176	4796	52
	NO-NDIR, ppm	96	84	99	63	45	67	27	46	-	-	-	100	-
	NO-CL, ppm	97	96	107	71	93	70	22	61	84	92	85	66	7
	NO_x-CL, ppm	126	104	110	81	98	70	25	61	87	96	87	70	7
	O_2, %	16.6	17.1	16.2	17.4	15.9	6.1	8.3	9.2	14.9	13.3	14.7	3.7	-
	CO_2, %	2.5	2.3	2.9	2.9	2.6	10.7	7.2	8.1	3.22	4.08	2.94	12.58	0.7
	Acrolein, ppm	0.9	1.9	0.9	6.7	1.7	0.7	2.9	0	8.5	1.6	1.5	6.0	
	Formaldehyde, ppm	4.0	4.4	2.7	14.4	3.1	8.4	18.4	1.7	46.3	17.9	13.5	6.6	
	Aliph. Alde., ppm	11.8	8.3	10.3	32.6	7.8	24.2	54.7	8.3	100.2	30.8	32.2	21.7	
	TIA	1.7	1.9	1.6	2.0	1.7	1.5	1.9	0.6	2.2	1.4	1.4	2.1	
	LCA, μg/l	42	24	13	63	13	3	34	0	146.1	13.5	13.4	34.7	
	LCO, μg/l	5.2	8.9	3.6	9.8	4.8	3.9	9.0	0.5	16.1	2.6	2.7	11.7	

*Intermediate Speed is 60 percent of high speed defined as the rpm in highest gear that coincides with 56 mph vehicle speed and level road load. Mid load is fuel rate midway between no load (neutral) and high load fuel rates. Ford LTD, both Capris and Chrysler gas turbine ran at 4 times level road load at 50 mph (full load) and 2 times level road load at 50 mph (mid load). Texaco TCCS and Honda CVCC were run at 3 times level road load at 50 mph (high load) and 1.5 times level road load at 50 mph (mid load). High speed (56 mph) and intermediate speeds based on preset road load settings at 50 mph. For additional test condition description, refer to Table 4.

higher at the standard timing . Assuming the timing was advanced on 10/8/74, the HC, CO and NO_x results are consistent. Taking the results of 10/11/74 at standard timing as the most representative, the HC at both speeds correlate well at no load and mid load. The high power conditions produced very low HC yet the odor persisted.

The TCCS engine includes a special Texaco developed oxidation catalyst system. During the extended steady state odor tests of five minutes duration, the catalyst was observed to be effective on HC and CO. The effect was not as rapid, with time, as has been seen with other oxidation units because the longer the vehicle operated, the lower the HC and CO became. In some cases, depending on the previous mode, the HC and CO increased with time. Examples of this were the idle and no load conditions at 1800 and 3000 rpm. Chart reading became most difficult since stabilized HC, and to a lesser extent CO, were normally not attained until the last part of the five-minute run. Since the odor panel rates the exhaust at a time between 30 and 90 seconds after reaching the operating speed and load, the HC and other gaseous emissions were then time-averaged during the panel observation period. This rationale would then allow correlation analysis of instrumental to odor values.

The Chrysler gas turbine gaseous emissions were obtained basically for future reference in the event additional test work was involved where replication of the conditions was required. Gas turbine emissions are typically very low in concentration because the engine has inherently low HC and CO and because of the large amount of excess air typically handled by such an engine. HC seemed to track well with observed odor in that at high speed and load, the HC was high and at other modes where odor was low, HC was low. The no load, intermediate speed, HC value was less than the high speed and load though the odor at no load was higher. These types of inconsistencies make correlation most difficult. The idle odor condition was the highest of the gas turbine, except cold start, yet the HC concentration was less than the high speed and load concentration. Consequently, except for the Peugeot, HC and oxygenates would be expected to perform poorly as predictors of observed diesel odor.

In reviewing Table 15 data, some general remarks can be made. First, no one engine or car was consistently the highest emitter. The TCCS HC were generally as high or higher than most, especially when operating on diesel fuel. Depending on operating condition, the TCCS fueled with gasoline was higher. The diesel fueled TCCS was highest in oxygenate production of all cars tested and only the Peugeot 504D approached the acrolein values. Formaldehyde and aliphatic aldehyde concentrations were as high or higher than any ever measured by SwRI and were substantially higher than the Peugeot even though odor ratings were quite comparable.

Comparing the diesel to the gasoline TCCS, the odor differences were occasionally but not generally borne out by the HC differences. Although HC was higher from the gasoline TCCS under several conditions, odor was always less. Thus, HC seems an even poorer indicator of exhaust odor where two different types of fuel, gasoline and diesel, are involved. From past diesel engine experience, HC at the rather high levels encountered from the TCCS engine should be fairly good in predicting observed odor.

There is a great deal more analysis that could be made of the data on Table 15. The DOAS results will be discussed in the next subsection. For additional, more detailed, summaries of the instrumental chemistry data taken simultaneously with odor tests, please refer to Appendix D. As with Appendix C, there are three tables per car, the first a summary of the two days of testing and one for each day, listing results of each run. The gas turbine values listed on Table 15 are overall averages of three separate odor tests in which each condition was run three times. Each gas turbine value is the average of nine measurements. Tables D-1 through D-34 may be helpful in later analyses, odor correlation, etc., beyond the intent of this report.

3. DOAS Results - Steady State

Table 15 listed the TIA, LCO, and LCA values for the seven steady state odor test conditions. These were summarized from the extensive individual run data tabulated in Appendix D. To facilitate comparison of the DOAS and trained panel results, Figures 24 and 25 are plots of the TIA versus observed "D" odor intensity. These graphs are based on average "D" and TIA data listed in Table 16. Table 16 is a summary recompilation of the DOAS values in Appendix D and the odor panel data in Appendix C.

Figure 24 illustrates the relationship of the "D" intensity and TIA for the four diesel cars and the diesel fueled TCCS. Note the full load conditions are grouped together at one end (solid points), the half load are grouped in the center of the graph (denoted by points half shaded), and no load points are all at the lower end of the graph for the Nissan and Mercedes. The TCCS, Peugeot and Opel diesel results showed less distinct grouping. This is not surprising relative to earlier analyses of the effect of load on odor, Figures 12-22.

A straight line could be drawn through the points plotted on Figure 24. Such a line would represent a linear relationship of predicted odor by TIA value, to that observed by the panel. More on this specific relationship will be discussed later. The item of importance is that there appears to be a relationship of TIA to observed diesel odor that is promising. The Peugeot no load points (open triangles) are some of the points furthest from a straight line relationship. This is the first

TABLE 16. COMPARISON OF TIA AND "D" ODOR VALUES

		Diesel Powered										Gasoline Powered									
		Nissan*		Mercedes		Peugeot		Opel		Tex. TCCS		Ford LTD		Capri Std.		Capri PROCO		Tex. TCCS**		Honda CVCC	
Condition	Day	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"	TIA	"D"
Idle	1st	1.5	2.9	1.6	3.1	1.9	4.8	1.8	3.5	2.1	4.8	1.8	1.1	2.0	3.2	0.8	0.7	1.4	2.7	2.1	3.4
	2nd	1.4	2.7	1.5	3.1	2.0	4.7	1.6	3.0	2.2	5.7	1.3	1.3	2.0	3.3	0.4	0.6	1.4	3.1	2.0	2.9
	Avg.			1.6	3.1	2.0	4.8	1.7	3.3	2.2	5.3	1.6	1.2	2.0	3.3	0.6	0.7			2.1	3.2
No load Inter. rpm	1st	1.6	3.1	1.6	2.7	2.1	6.2	1.7	3.5	2.5	6.0	1.8	1.8	2.0	2.5	0.8	0.7	1.9	3.7	1.5	2.4
	2nd	1.6	3.1	1.6	2.5	2.2	5.7	1.7	3.5	2.4	5.4	1.5	2.1	1.9	2.9	0.7	0.8	1.7	4.5	1.3	1.7
	Avg.			1.6	2.6	2.2	6.0	1.7	3.5	2.5	5.7	1.7	2.0	2.0	2.7	0.8	0.8			1.4	2.1
Mid load Inter. rpm	1st	1.7	2.8	1.6	2.5	2.1	4.4	1.9	4.3	2.5	5.4	1.8	1.2	2.2	3.4	0.8	0.8	1.5	2.8	1.3	1.4
	2nd	1.6	3.0	1.5	2.7	2.1	3.7	1.8	4.0	2.5	5.3	1.7	1.7	2.2	2.6	0.6	0.7	1.6	3.2	1.3	1.5
	Avg.			1.5	2.6	2.1	4.1	1.9	4.2	2.5	5.4	1.8	1.5	2.2	3.0	0.7	0.8			1.3	1.5
High load Inter. rpm	1st	1.8	3.8	1.7	3.5	2.0	4.7	1.9	3.6	2.4	5.7	1.9	0.9	2.2	3.4	0.7	1.3	1.5	3.4	1.3	1.4
	2nd	1.8	3.7	1.6	3.3	2.2	4.6	1.9	3.8	2.4	4.3	1.7	1.5	2.3	3.3	0.4	0.7	1.4	3.0	1.0	1.5
	Avg.			1.7	3.4	2.1	4.7	1.9	3.7	2.4	5.0	1.8	1.2	2.3	3.4	0.6	1.0			1.2	1.5
No load High rpm	1st	1.5	2.4	1.6	2.3	2.1	6.3	1.8	3.3	2.5	6.1	1.9	1.4	2.1	2.6	0.9	1.0	1.9	3.9	1.5	2.2
	2nd	1.5	2.1	1.5	2.8	2.1	5.7	1.8	3.3	2.6	6.0	1.8	1.5	1.8	1.7	0.6	0.6	2.0	4.1	1.2	1.6
	Avg.			1.6	2.6	2.1	6.0	1.8	3.3	2.6	6.1	1.9	1.5	2.0	2.2	0.8	0.8			1.4	1.9
Mid load High rpm	1st	1.7	3.7	1.6	3.2	2.1	4.9	2.1	4.8	2.2	4.2	1.8	1.0	2.2	3.5	0.6	1.4	1.5	2.9	1.2	1.5
	2nd	1.6	3.1	1.5	2.9	2.1	4.4	1.9	4.1	2.4	4.6	1.5	1.1	2.2	3.4	0.6	0.8	1.4	2.5	1.5	1.7
	Avg.			1.6	3.1	2.1	4.7	2.0	4.5	2.3	4.4	1.7	1.1	2.2	3.5	0.6	1.1			1.4	1.6
Highload High rpm	1st	1.7	4.8	1.9	3.7	2.4	5.9	2.1	3.9	2.2	4.8	1.7	1.1	2.2	3.1	1.2	1.4	1.3	3.3	1.4	1.7
	2nd	1.9	3.9	1.8	4.1	2.5	5.2	2.0	4.1	2.2	4.7	1.5	1.7	2.1	3.4	1.1	1.1	1.2	3.0	1.2	1.5
	Avg.			1.9	3.9	2.5	5.6	2.1	4.0	2.2	4.8	1.6	1.4	2.2	3.3	1.2	1.3			1.3	1.6

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*1st day winter, 2nd day summer.

**1st day 10-8-74, 2nd day 10-11-74

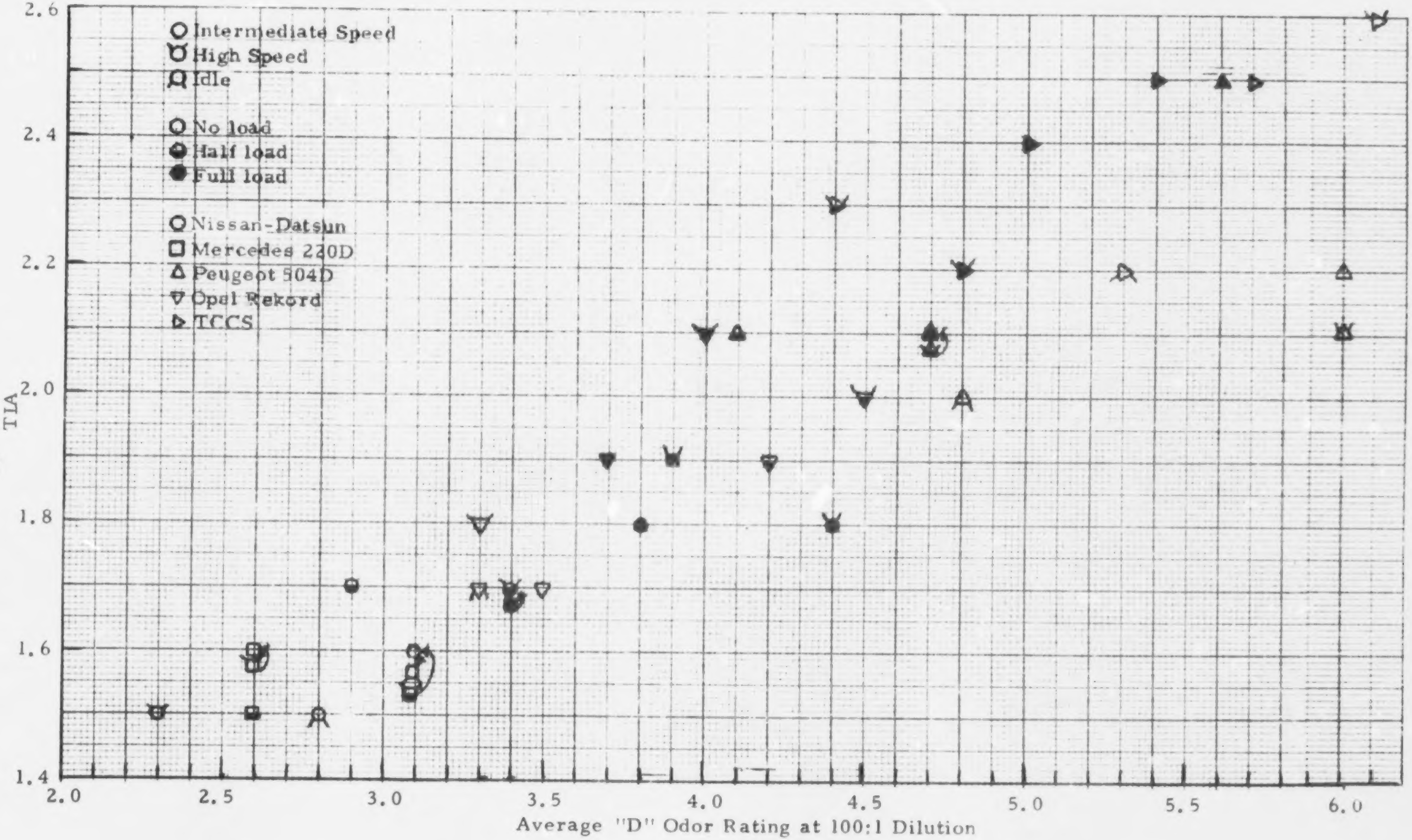

FIGURE 24. PERCEIVED "D" ODOR INTENSITY VERSUS TIA BY DOAS FOR FOUR DIESEL CARS AND A DIESEL FUELED TEXACO TCCS
100:1 Dilution

such opportunity to use the DOAS instrument on a variety of diesel fueled engines with odor panel measurement simultaneously.

Figure 25 is a similar plot to Figure 24 but is for the three gasoline cars. Recall that the DOAS was not developed for engines and fuels other than the diesel. The results plotted on Figure 25 should therefore be considered alone and distinctly from that on Figure 24. It is interesting to note that for the five gasoline cars, the relationship is not nearly as linear looking as the four diesels. Note the general scatter of the data on Figure 25, the Honda CVCC and Texaco TCCS both had lower TIA values than the other three cars. If a straight line were drawn, a slope of about 0.2 TIA per "D" bottle intensity is noted. This slope is about the same as that roughly determined for the diesel car relationship of Figure 24.

Below about "D"-1.5 on Figure 25, however, the slope of the relationship, if in fact there is any, changes radically and is much steeper. It may be possible that the instrumental method is still working as it should but the limit of supra-threshold panel operation has been exceeded. As mentioned before in this and the Part V final report(14), panel evaluation of low odor levels, below "D"-2, becomes imprecise rapidly as odor strength is further reduced. This is probably a good reason, though probably not the only reason, for the noticeable break in the data. The majority of the very low odor levels were from the stratified charge PROCO Capri equipped with oxidation catalyst. Both items likely had a bearing on the results and could be reasons for the change in DOAS-Panel relationship. The LCO, on which the TIA is based, may well have been greatly decreased in this car without affecting odor.

There probably is some minimum cut-off or limit to which the DOAS is applicable in the TIA = 1 + $\log_{10}$ LCO. This entire question has yet to be fully investigated for diesel exhaust, much less gasoline burning engines. It is nothing short of good fortune that the DOAS even worked with a gasoline engine exhaust, much less gave LCO values which, when converted to TIA came out predicting about the same increase in odor per increment of TIA as the diesels. The problems below "D"-1.5 are not surprising and not totally unexpected.

Ten graphs, one for each car, known as Figures E-1 through E-10 of LCA, LCO and TIA versus power level are included in Appendix E. These plots are intended to help in relating DOAS results to the odor, HC and oxygenate results previously discussed. Recall the Nissan, Mercedes and both Capri autmobile odor ratings increased more or less with power. It is fairly safe to state from Figures E-1, E-2, and E-6 that the DOAS LCA, LCO, and TIA also increased with load. A notable exception was the Ford PROCO which was not consistent. Previous concern over the odor and DOAS ratings from this low emis-

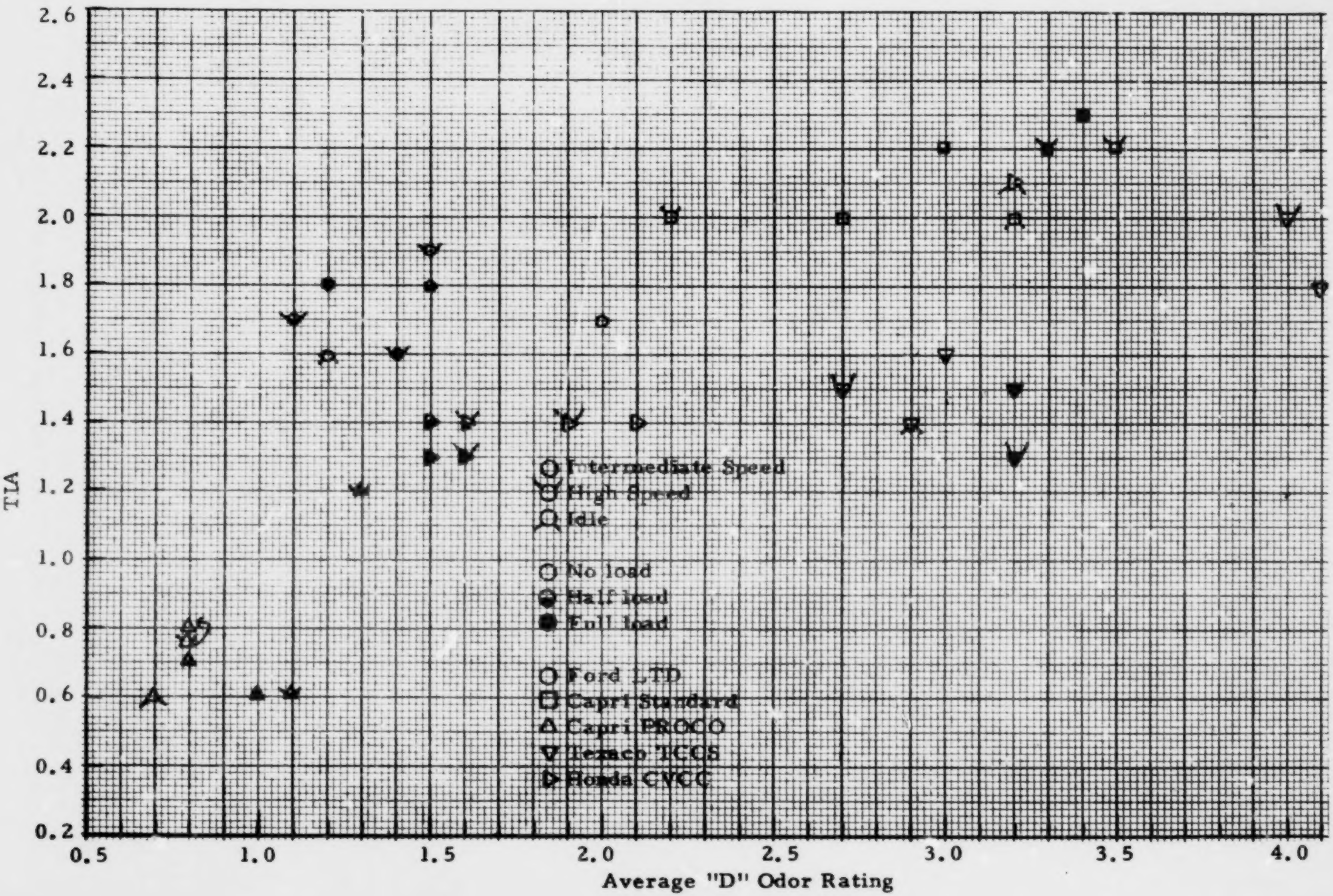

FIGURE 25. PERCEIVED "D" ODOR RATING VERSUS TIA BY DOAS FOR FORD LTD, STANDARD CAPRI, PROCO CAPRI, TEXACO TCCS AND HONDA CVCC GASOLINE CARS
100:1 Dilution

sion car may explain this lack of correspondence and vice versa.

The Peugeot 504D has definitely minimum odor and HC at half load. So did the LCA, LCO and TIA from Figure E-3. The Opel LCO and TIA tended to increase consistently with an increase in load. So, only a partial agreement of DOAS trend with odor panel "D" ratings is apparent. The Ford LTD basically had slightly less odor with increase in load. The TIA, from Figure E-5, did not demonstrate a consistent trend. Only the 2000 rpm TIA increased with load. The TIA increased slightly at 1200 rpm as load increased.

The Texaco TCCS powered vehicle (diesel fuel) showed TIA, LCO, and LCA values (Figure E-8, that were in basic agreement with the odor data except at 3000 rpm, high load. The same engine, operating on gasoline, produced LCO (TIA) and LCA that agreed trendwise with the odor results at no load and mid load. Odor was increased at high power, Figure 20, yet TIA, etc., decreased per Figure E-9. The higher odor levels of the diesel TCCS, on the order of "D"-4.5 to 6, were related to TIAs of 2.2 to 2.6. The gasoline fueled TCCS had observed odor intensities ranging from "D"-2.5 to 4.5 with TIAs ranging from 1.3 to 2.0. It seems that one TIA unit is approximately equal to about two "D" odor units from this analysis. From Figure 24, this relationship of 1 TIA = 2 "D" is probably close but the same is not as true from the gasoline data plotted on Figure 25.

The Honda CVCC DOAS results, plotted in Figure E-10, corresponded fairly well with the decrease in odor with increasing load as shown in Figure 21. From these modal trends, the degree of agreement between TIA and "D" rating is greater than the instances of disagreement. For this reason, it must be concluded that the CAPE 7 DOAS system is worth further research and evaluation. It appears to have promise for steady-state odor prediction although it appears far from total agreement with the SwRI odor panel.

4. DOAS Results - Transient

An attempt was made to obtain TIA, LCO, and LCA values during the 1975 FTP light duty test procedure. The object was to try and relate transient TIA values to various odor ratings obtained by the ten mode odor evaluation using the trained panel. Figure 26 is a bar chart summary of the average 1975 FTP transient test LCA, LCO, and TIA results. The difference in observed odor from the Peugeot and TCCS (diesel) relative to the other vehicles is accentuated on Figure 26 especially by the LCA graph. LCO and TIA were also significantly higher than the other cars.

It may not be proper to show the gasoline DOAS results on the same chart with the diesel. But, the preliminary nature of the test,

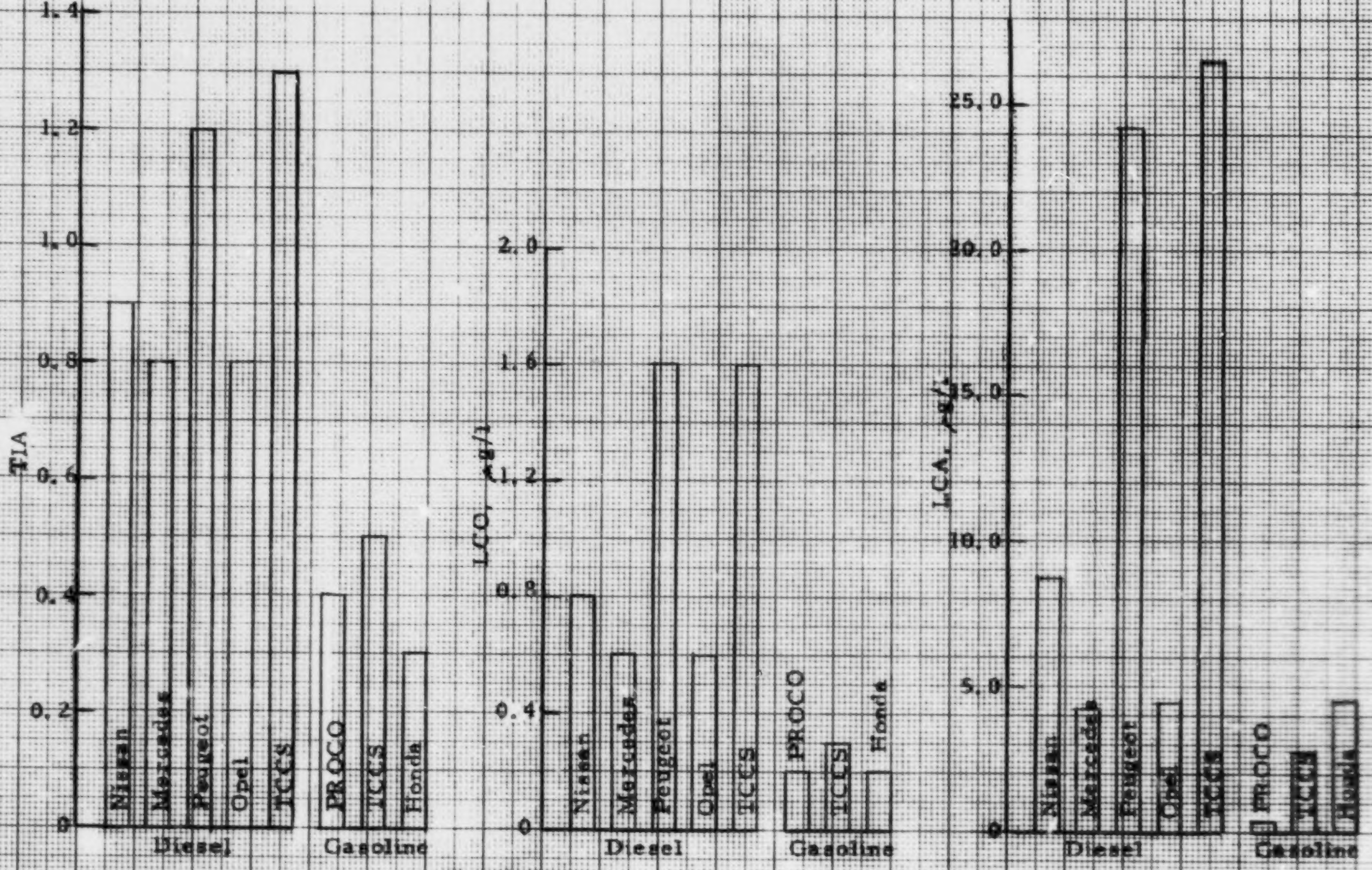

FIGURE 26. SUMMARY OF 1975 FTP DOAS RESULTS

this being the first time such tests have been attempted with the transient test, may wash out the fact the system was intended for diesels. The 1975 FTP DOAS results for the four gasoline powered cars thus tested all resulted in the lowest measurements of the entire group. TIA and LCO gave highest odor prediction to the TCCS with the CVCC and PROCO about equivalent. LCA was lowest for the PROCO, possibly due to the combination of stratified charge engine and the specific oxidation catalyst employed. For a compilation of the DOAS results for each run, please refer to Table F-1 of Appendix F.

Figure 27 is an attempted correlation of the transient TIA results with the arithmetic average of the ten mode odor test results. Also shown on Figure 27 are plots of average TIA for the 1975 FTP versus the seven steady state and the three transient modes. The average odor panel ratings assume equal weight to each mode and are from the data on Table 14. As expected from the basic data, the Peugeot and diesel fueled TCCS stand alone as having highest TIA and observed odor regardless of modal groupings. The PROCO and CVCC are at the opposite end of the graph as having very low odor (PROCO) or very low TIA (CVCC). The remaining diesel and gasoline powered cars are in the middle.

The conclusion from this limited but informative test series is that TIA from a 1975 FTP tends to correlate more or less with observed odor from the ten mode test sequence for the same group of cars thus tested. One implication of such a conclusion is that it might be possible to determine odor from a car operating on a purely transient test, where an odor panel is incapable of operating. This supposes, of course, that the TIA to odor panel relationship has been previously established and that the relationship is sufficiently close to justify its use. The full potential of this finding has yet to be explored. This is one of the more interesting developments of the project, however.

5. Prediction of Observed "D" Odor Ratings by TIA

As a natural consequence of the steady state tests performed with the four diesels, the TIA, LCO, and LCA data was subjected to a multiple linear regression analysis with the observed "D" ratings obtained at the same time. This analysis was limited to the four diesel engines since the DOAS was developed strictly for use with diesel engine exhaust odor. Each of the other engines included in this project were "one-of-a-kind" or were distinctly different in their fuel requirements or design features to make their inclusion in a regression analysis premature.

Appendix Tables G-1 through G-4 list the pertinent values used for each of the four cars. The observed DOAS results and the panel "D" rating were the measured inputs. The last three columns on each table

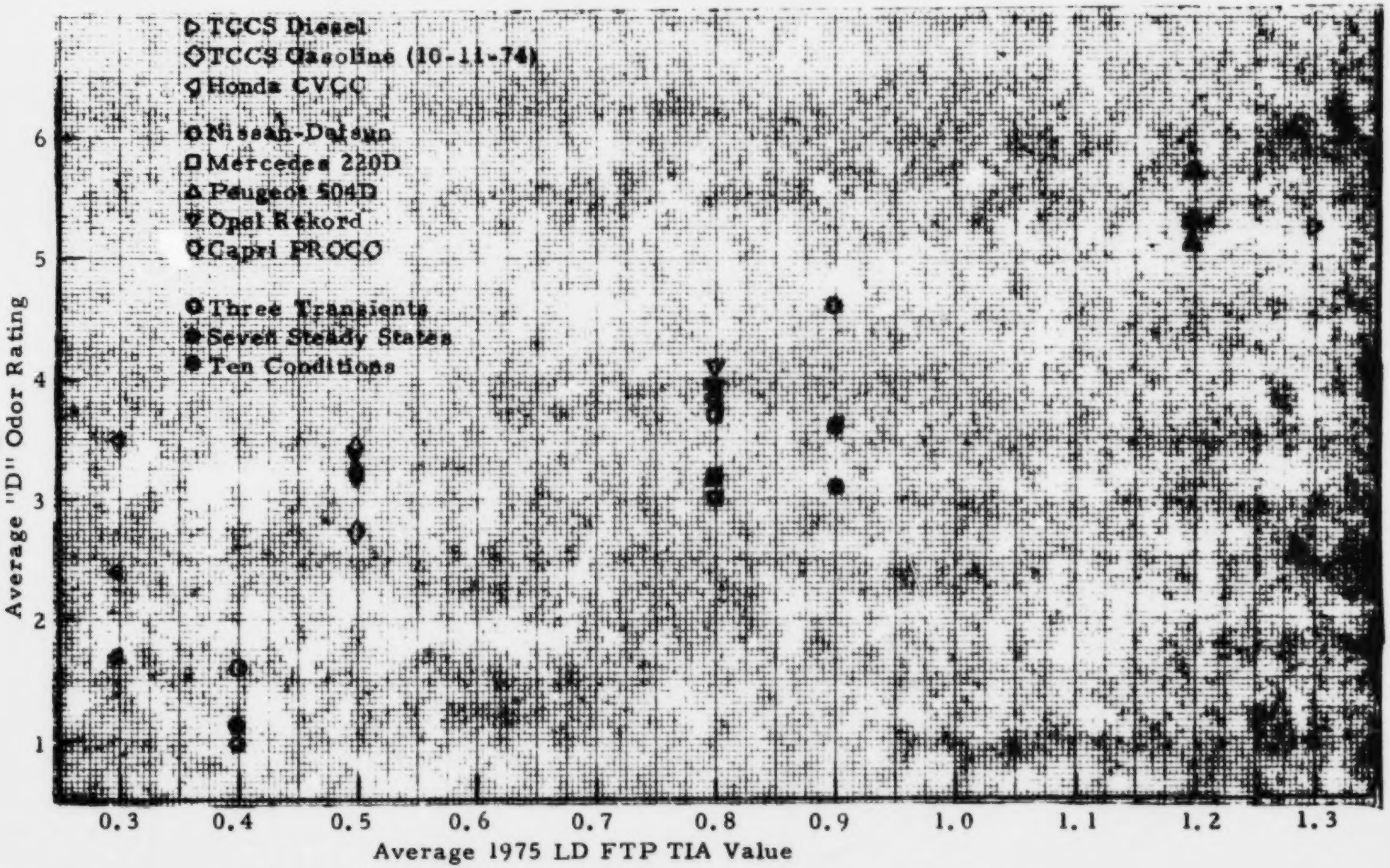

FIGURE 27. CORRELATION OF AVERAGE 1975 FTP TIA VALUES WITH STEADY STATE AND TRANSIENT AVERAGE "D" ODOR RATINGS

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are the predicted "D" odor intensity using the following three equations:

Equation 1: $"D" = -2.0 + 3.2\,(TIA)$

2: $"D" = -0.69 + 2.3\,(TIA) + 0.045\,(LCA)$

3: $"D" = -2.9 + 4.0\,(TIA) + 0.012\,(LCA) - 0.14\,(LCO)$

where LCA and LCO are in g/l
and LCA is based on the ADL LCA standard

If, for example, the TIA value is used alone, then equation 1 would be used and the predicted value would be above (+) or below (-) the observed value as shown in Table 17 "diff" column. The TIA did better on some cars than others. The Nissan odor was predicted best and the Mercedes next best. The prediction of the Peugeot odor was poorest of the four in comparison to the observed odor. In general, the overall prediction of all cars, if lumped together, was fairly close.

Odor research, however, is a science of specific engines and conditions and for the DOAS to be of maximum usefulness, it would seem that it must predict odor on most any diesel engine under most any condition. In the case of the Peugeot and Opel, where the predicted odor occasionally was substantially higher or lower than observed, the use of the LCA, equation 3, was found, in combination with TIA and LCO, to give a slightly better overall prediction. In other instances, use of the LCA is questionable. The issue of concern is when to use LCA in the equation and when not to since the researcher will likely not have the luxury of a trained panel and their necessary facilities to help him decide.

Of even greater concern is that usefulness of any predictive method depends on its ability to correlate with perceived odor. The DOAS does correlate with the panel. Its correlation is far from perfect and to some merely marginal at best. The degree of agreement or precision of predictability is an elusive target as it depends on the end use of the results. For research purposes, most any degree of correlation might do. However, as there is more and more at stake, inaccuracies in odor measurement may not be tolerated to the extent usually encountered, thus the need for an improved odor measurement method.

There is no doubt that the odor prediction accuracy can be no better than the odor measurement accuracy in the first place. Then if ±0.5 "D" is the accuracy of the odor panel, ±0.5"D" by the predictive method using TIA would be equivalent. It would be except the predictive method is based on the observed rating, thus the premise that the predictive method, any predictive method, cannot exceed the accuracy of the odor panel or human observer. It could approach and on rare

TABLE 17. DIFFERENCE IN OBSERVED AND PREDICTED "D" ODOR INTENSITY BASED ON TIA (FOUR DIESEL CAR TEST)

		Nissan - Datsun			Mercedes 220D			Peugeot 504D			Opel Rekord		
Condition	Day	Obs	Pred	Diff	Obs	Pred	Diff	Obs	Pred	Diff	Obs	Pred	Diff
Idle	1(W)	2.9	2.8	-.1	3.1	3.1	0	4.4	4.1	-.3	3.5	3.8	+.3
	2(S)	2.7	2.5	-.2	3.1	2.8	-.3	4.7	4.4	-.3	3.0	3.1	+.1
Intermediate Speed, No Load	1	3.1	3.1	0	2.7	3.1	+.4	6.2	4.7	-1.5	3.5	3.4	-.1
	2	3.1	3.1	0	2.5	3.1	+.6	5.7	5.0	-.7	3.1	3.4	+.3
Intermediate Speed, Half Load	1	2.8	3.4	+.6	2.5	3.1	+.6	4.4	4.7	+.3	4.3	4.1	-.2
	2	3.0	3.1	+.1	2.7	2.8	+.1	3.7	4.7	+1.0	4.0	3.8	-.2
Intermediate Speed, Full Load	1	3.8	3.8	0	3.5	3.4	-.1	4.7	4.4	-.3	3.6	4.1	+.5
	2	3.7	3.8	+.1	3.3	3.1	-.2	4.6	5.0	+.4	3.8	4.1	+.3
High Speed, No Load	1	2.4	2.8	+.4	2.3	3.1	+.8	6.3	4.7	-1.6	3.3	3.8	+.5
	2	2.1	2.8	+.7	2.8	2.8	0	5.4	4.7	-.7	3.3	3.8	+.5
High Speed, Half Load	1	3.7	3.4	-.3	3.2	3.1	-.1	4.9	4.7	-.2	4.8	4.7	-.1
	2	3.1	3.1	0	2.9	2.8	-.1	4.4	4.7	+.3	4.1	4.1	0
High Speed, Full Load	1	4.8	3.4	-1.4	3.7	4.1	+.4	5.9	5.7	-.2	3.9	4.7	+.8
	2	3.9	4.1	+.2	4.1	3.8	-.3	5.2	6.0	+.8	4.1	4.4	+.3

occasions be identical but never better.

6. Light HC and HC Distribution

Table 18 lists the results of GC and GLC analyses of bag and DOAS trapped samples of raw exhaust hydrocarbons. These measurements were made of samples obtained simultaneously with odor ratings under the seven steady-state modes. For each mode, the four light hydrocarbons present are listed in mole percent, i.e., by weight percent. On the surface, the differences in light HC by the two procedures should be even greater since Table 9 transient results were of diluted bags. The steady state runs, however, were under more optimum, higher temperature conditions and may be the reason for the minimal differences found. The GLC sample of the trapped material is then listed to indicate the distribution of HC as "less than C_{12}", C_{20} and above, and in four regions in between.

The results on Table 18 may be compared to those on Table 9 for the 1975 FTP transients. Of the four light hydrocarbons, methane concentration continued to be the highest under most conditions. The Peugeot and Opel at no load-intermediate speed, no load-high speed, idle, and Peugeot half load-high speed were notable exceptions in which ethylene was more predominant.

In general, the light HC results seem reasonable compared with the transient values on Table 9. The Peugeot tended to have the highest concentrations of the light HC and the Mercedes the lowest of the group of four diesels by both transient and steady state tests. These are general observations of the concentration data. The light HC consist of methane, ethylene, acetylene, and propylene by GC analysis of the raw exhaust sample. Other light HC, such as butane, propane, and ethane were not present in detectable levels by the method used. The other diesel fueled car, the TCCS, had light hydrocarbons that were on a par or greater than the four diesels at no load and while at high load, the reverse was true. The generally lower light HC at high load may have been a function of the oxidation catalyst.

Also listed on Table 18 are the gasoline fueled car results. The standard Capri had substantially more light hydrocarbons than the other gasoline cars. This is not surprising since the Ford LTD, PROCO, and TCCS powered vehicle use an oxidation catalyst. As with the diesel TCCS, the effect of the catalyst was probably greater on the amount of light HC production at high load than at no load. Some of the TCCS ethylene and propylene values were as high as any other car during light loads though not as high as the TCCS diesel or the standard Capri.

In the non-catalyst gasoline engine exhaust, acetylene, ethylene and propylene are of more abundance than the catalyst cars. Except

TABLE 18. DISTRIBUTION OF EXHAUST HYDROCARBON EMISSIONS DURING STEADY STATE ODOR TESTS

Vehicle Condition	Exhaust Emission	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	Texaco TCCS		Honda CVCC
									Diesel	Gasoline	
Intermediate Speed, no load	Light Hydrocarbons										
	Methane, ppmC	12.8	12.2	4.6	2.1	3.7	58.1	6.1	7.2	7.3	5.6
	Ethylene, ppmC	4.2	3.4	8.3	4.8	9.3	60.3	0.0	64.8	51.8	35.3
	Acetylene, ppmC	1.2	1.3	4.0	2.0	0.0	102.8	0.0	86	8.6	12.1
	Propylene, ppmC	1.0	0.6	2.6	1.1	1.3	22.9	0.0	40.3	38.9	9.0
	HC Distribution, mole %										
	$<C_{12}$	3.5	3.2	3.0	3.2	-	-	-	3.1	-	-
	C_{12}-C_{13}	14.5	14.4	14.5	14.6	-	-	-	14.3	-	-
	C_{14}-C_{15}	37.0	37.0	36.8	36.0	-	-	-	36.9	-	-
	C_{16}-C_{17}	26.8	27.0	27.2	26.7	-	-	-	27.7	-	-
	C_{18}-C_{19}	16.2	16.4	16.0	16.0	-	-	-	16.3	-	-
	C_{20}^+	3.0	2.0	2.5	2.5	-	-	-	1.7	-	-
Intermediate Speed, mid load	Light Hydrocarbons										
	Methane, ppmC	5.4	6.3	3.6	7.5	5.6	26.7	2.1	10.5	8.2	1.2
	Ethylene, ppmC	2.6	2.8	3.3	6.3	25.3	113.4	0.4	11.9	4.3	15.2
	Acetylene, ppmC	1.0	1.0	2.5	1.6	0.3	55.0	0.1	1.4	0.4	7.1
	Propylene, ppmC	0.5	0.6	0.9	1.5	3.5	44.9	0.0	8.3	2.6	8.2
	HC Distribution, mole %										
	$<C_{12}$	3.3	3.3	3.2	3.4	-	-	-	3.6	-	-
	C_{12}-C_{13}	14.3	14.3	14.3	14.1	-	-	-	14.1	-	-
	C_{14}-C_{15}	37.2	37.5	37.3	36.5	-	-	-	37.1	-	-
	C_{16}-C_{17}	26.8	26.5	26.7	26.4	-	-	-	26.7	-	-
	C_{18}-C_{19}	15.7	16.3	16.4	15.9	-	-	-	16.4	-	-
	C_{20}^+	2.7	2.1	2.1	2.7	-	-	-	2.1	-	-
Intermediate Speed, high load	Light Hydrocarbons										
	Methane, ppmC	8.2	4.6	8.8	7.8	5.8	18.8	3.4	16.6	7.3	0.0
	Ethylene, ppmC	4.7	1.9	5.0	3.2	26.6	63.4	0.3	9.0	2.2	1.1
	Acetylene, ppmC	3.4	1.3	6.7	1.0	0.2	42.2	0.0	3.1	0.0	1.4
	Propylene, ppmC	0.5	0.3	1.3	0.8	3.6	52.1	0.0	6.1	1.4	0.0
	HC Distribution, mole %										
	$<C_{12}$	3.8	3.6	3.3	3.5	-	-	-	3.3	-	-
	C_{12}-C_{13}	13.8	14.0	14.2	14.0	-	-	-	14.4	-	-
	C_{14}-C_{15}	36.9	37.2	37.1	36.3	-	-	-	36.8	-	-
	C_{16}-C_{17}	27.1	26.8	26.9	26.7	-	-	-	27.8	-	-
	C_{18}-C_{19}	15.8	16.2	16.3	16.0	-	-	-	16.1	-	-
	C_{20}^+	2.6	2.2	2.2	2.5	-	-	-	1.6	-	-
High Speed, no load	Light Hydrocarbons										
	Methane, ppmC	11.7	11.8	2.4	2.8	3.8	5.2	3.2	9.7	13.4	0.0
	Ethylene, ppmC	2.7	3.6	3.5	4.6	18.6	4.8	0.4	68.4	23.8	2.9
	Acetylene, ppmC	1.4	1.6	2.1	1.0	0.3	8.4	0.0	3.3	3.0	0.7
	Propylene, ppmC	0.2	0.3	0.9	1.5	4.1	2.2	0.0	24.5	30.2	2.5
	HC Distribution, mole %										
	$<C_{12}$	3.4	3.4	3.2	3.3	-	-	-	3.2	-	-
	C_{12}-C_{13}	14.2	14.2	14.3	14.2	-	-	-	14.7	-	-
	C_{14}-C_{15}	37.0	36.9	37.5	36.7	-	-	-	35.1	-	-
	C_{16}-C_{17}	27.3	27.1	26.5	26.7	-	-	-	26.5	-	-
	C_{18}-C_{19}	15.6	16.3	16.3	16.8	-	-	-	15.9	-	-
	C_{20}^+	2.5	2.1	2.2	2.3	-	-	-	2.5	-	-

TABLE 18 (Cont'd). DISTRIBUTION OF EXHAUST HYDROCARBON EMISSIONS DURING STEADY STATE ODOR TESTS

Vehicle Condition	Exhaust Emission	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Ford LTD	Capri Std.	Capri PROCO	Texaco TCCS		Honda CVCC
									Diesel	Gasoline	
High Speed, mid load	Light Hydrocarbons										
	Methane, ppmC	3.8	5.2	6.6	9.1	13.4	28.2	1.7	5.4	4.8	2.1
	Ethylene, ppmC	1.6	2.3	11.3	5.0	6.3	70.1	0.2	12.2	3.5	17.6
	Acetylene, ppmC	0.6	1.5	6.3	1.1	0.3	67.1	0.0	0.7	0.3	10.6
	Propylene, ppmC	0.1	0.6	3.0	1.4	1.2	44.4	0.0	4.7	1.3	3.1
	HC Distribution, mole %										
	$<C_{12}$	3.3	3.3	3.4	3.2	-	-	-	3.0	-	-
	C_{12}-C_{13}	14.4	14.2	14.1	14.3	-	-	-	14.5	-	-
	C_{14}-C_{15}	37.1	37.4	37.0	35.8	-	-	-	36.8	-	-
	C_{16}-C_{17}	26.7	26.6	27.0	27.2	-	-	-	27.2	-	-
	C_{18}-C_{19}	15.8	16.5	15.9	16.2	-	-	-	16.0	-	-
	C_{20}^{+}	2.7	2.0	2.6	2.3	-	-	-	2.5	-	-
High Speed, high load	Light Hydrocarbons										
	Methane, ppmC	10.5	3.5	7.7	3.3	8.9	73.4	7.6	0.4	0.2	1.3
	Ethylene, ppmC	6.1	3.8	7.4	3.2	3.0	88.0	2.7	1.2	2.6	2.6
	Acetylene, ppmC	6.5	1.6	8.9	1.0	0.4	60.0	0.3	0.0	0.0	4.5
	Propylene, ppmC	0.2	0.7	0.8	0.9	0.6	79.5	0.0	0.7	0.9	3.9
	HC Distribution, mole %										
	$<C_{12}$	3.5	3.5	3.3	3.4	-	-	-	3.6	-	-
	C_{12}-C_{13}	14.1	14.1	14.2	14.3	-	-	-	14.0	-	-
	C_{14}-C_{15}	37.2	38.0	37.6	36.1	-	-	-	37.2	-	-
	C_{16}-C_{17}	26.6	26.0	26.4	26.7	-	-	-	26.8	-	-
	C_{18}-C_{19}	15.8	16.4	16.2	15.8	-	-	-	16.2	-	-
	C_{20}^{+}	2.8	2.0	2.3	2.7	-	-	-	2.2	-	-
Idle	Light Hydrocarbons										
	Methane, ppmC	12.4	12.6	2.2	1.7	4.0	122.9	4.0	13.0	9.1	19.8
	Ethylene, ppmC	2.3	5.7	3.0	6.9	8.7	119.0	0.4	72.0	4.3	150.9
	Acetylene, ppmC	0.6	2.1	1.2	3.1	0.0	165.5	0.0	10.8	0.0	31.5
	Propylene, ppmC	0.5	1.6	0.8	1.0	0.7	69.3	0.0	68.4	4.8	79.8
	HC Distribution, mole %										
	$<C_{12}$	3.4	3.4	3.2	3.3	-	-	-	3.3	-	-
	C_{12}-C_{13}	14.2	14.3	14.3	14.7	-	-	-	14.1	-	-
	C_{14}-C_{15}	37.3	37.6	37.2	36.4	-	-	-	27.2	-	-
	C_{16}-C_{17}	26.7	26.4	26.8	26.6	-	-	-	26.9	-	-
	C_{18}-C_{19}	15.9	16.3	16.1	15.7	-	-	-	16.2	-	-
	C_{20}^{+}	2.5	2.0	2.4	2.3	-	-	-	2.3	-	-

Note: HC distribution based on DOAS Chromosorb 102 trapped sample for odor analysis.
HC distribution for gasoline cars not run due to Elution Solvent Interference

at idle, the Honda CVCC, a non-catalyst vehicle, was an exception to the light HC trend shown by the standard Capri. The ethylene concentrations for the Ford LTD and PROCO cars were quite different at the intermediate speed. The LTD ethylene was much higher than would be anticipated. Possibly the low engine speed of 1200 rpm was the reason. Recall that the LTD odor and other emissions such as DOAS were somewhat different at 1200 than at 2000 rpm. Only methane of the four light HC seemed to persist in the PROCO exhaust. This finding is in agreement with the 1975 LD FTP transient results on Table 9.

The remainder of Table 18 are the HC distributions from C_{12} to C_{20}. The gasoline fueled cars were not included in this analysis due to the substantially lower boiling range of gasoline and gasoline engine exhaust hydrocarbons. In the discussion of Table 9, it was stated that over sixty percent of the HC were between C_{14} and C_{18}. The same holds true for the modal results of Table 18. In fact, there appears to be very little difference in the mole percent between the four diesels and the TCCS (diesel) for each portion of the distribution. About 3 to 3.5 percent below C_{12}, 14 to 14.5 percent C_{12}-C_{13}, 36 to 38 percent C_{14}-C_{15}, 26 to 27.5 percent C_{16}-C_{17}, 15.5 to 16.5 percent C_{18}-C_{19} and 2 to 3 percent C_{20} and above. Except for the C_{20} and above, these general conclusions are very similar to the results on Table 9. Since these analyses were made with concentrated trap samples and expressed in mole percent, there should be no difference due to whether a dilute or raw sample was collected, trapped, and analyzed. Further analysis of this basic data is beyond the scope of this project.

D. 1974 HD Diesel Smoke FTP

The results of the chassis simulated Federal smoke test are summarized on Table 19. The "a" accel factors are listed first, followed by the "b" lugdown and "c" peak smoke values. Three separate runs were made and their individual results and average shown. Run-to-run repeatability was termed good with the exception of the Opel diesel run 1 versus runs 2 and 3. Only the four diesel cars were operated on this procedure, basically intended for diesel engines in trucks and buses.

The following are the smoke limits specified for the U. S. beginning in 1970 and 1974 calendar years.

		Federal Factor, % Opacity		
		"a"	"b"	"c"
Federal HD Limits	1970	40	20	--
	1974	20	15	50

Although the chassis version is only a simulation of the Federal Test

TABLE 19. EXHAUST SMOKE OPACITY READINGS
(Chassis Version of Federal Procedure)

Federal Smoke	Run No.	Nissan Summer	Mercedes 220D	Peugeot 504D	Opel Rekord
"a" factor	1	4.7	2.8	4.1	7.0
	2	4.6	3.6	4.0	4.8
	3	5.0	3.6	3.1	4.3
	Avg.	4.8	3.3	3.7	5.4
"b" factor	1	5.4	2.3	5.0	10.0
	2	5.4	2.9	3.9	6.3
	3	6.2	2.8	3.0	5.9
	Avg.	5.7	2.7	4.0	7.4
"c" factor	1	5.9	4.6	6.3	11.1
	2	5.7	5.3	5.8	6.8
	3	6.6	5.3	4.2	6.8
	Avg.	6.1	5.1	5.4	8.2

TABLE 20. AVERAGE STEADY STATE SMOKE READINGS DURING FULL POWER OPERATION

Nissan Summer		Mercedes 220D		Peugeot 504D		Opel Rekord	
rpm	Opacity	rpm	Opacity	rpm	Opacity	rpm	Opacity
4000	5.0	4200	2.5	4500	3.0	4300	11.8
3600	8.0	3800	2.5	4100	3.8	3900	9.8
3200	6.5	3400	2.1	3700	4.4	3500	5.5
2800	4.5	3000	2.2	3300	3.3	3100	5.5
2400	4.2	2600	2.4	2900	4.5	2700	5.5
2000	3.5	2200	3.1	2500	7.1	2500*	8.8
1600	3.2	1800	4.2	2100	6.3		

---

*Downshifting of automatic transmission prevented operation below 2450 rpm.

Procedure, it is helpful to relate to these Federal limits as a frame of reference. The Table 19 "a", "b" and "c" factors are all well below the Federal limits for 1974 as they should be. The smoke levels of the four diesel cars can better be compared to the limit of visibility of exhaust smoke which is generally considered to be about three to four percent opacity by the U. S. EPA full flow smokemeter used in this work.

The Mercedes and Peugeot both had "a" and "b" factors that are considered very light as far as visibility is concerned. The "c" factor is a peak smoke indication which means that at some short interval in the test, smoke was in the vicinity of the "c" factor. The Opel diesel car was the only vehicle to have what may be considered to be smoke levels that would be noticed by a casual observer. The other cars would be noticed only by someone who was interested in noticing the smoke discharge. Appendix H includes the work sheets used to compute the smoke factors. Please refer to these data sheets for specific opacity readings taken from the strip charts from which the "a", "b" and "c" factors were derived.

Table 20 lists the steady state smoke levels recorded at 400 rpm increments from rated to below peak torque speed. These measurements, made at maximum throttle or load, illustrate the effect of engine speed on smoke behavior. Figure 28 is a plot of smoke opacity versus engine speed for the four diesels. The Nissan showed an increase in smoke with rpm to 3600 rpm and then a reduced output at 4000 rpm. The Mercedes 220D engine decreased some in smoke output with an increase in speed. The Peugeot 504D smoke decreased with an increase in speed whereas the Opel Rekord increased steeply above 3500 rpm and below 2700 rpm. From Figure 28, it is hard to generalize about the visible smoke from diesel engines in light duty applications under conditions of maximum load.

It is interesting to compare the Mercedes smoke results to that reported in references 1 and 3. The exhaust smoke in the 1974 tests was about one-third that reported several years ago. There are several possible reasons such as the cars were different year, or the cars could have been adjusted differently. One fact is known and that is the current tests revealed about 20 percent lower fuel rate than specified by the manufacturer. What this means is the engine was operating in a derated condition and this may have been one important reason for the lower smoke readings.

A series of transient driving tests using the LA-4 (1975 FTP) schedule were made with each vehicle. These replicate tests demonstrated the ability of the U.S. EPA smokemeter to be used with a diesel or stratified charge powered car during this transient chassis dynamometer test. Evaluation of the traces has, of necessity, been of a

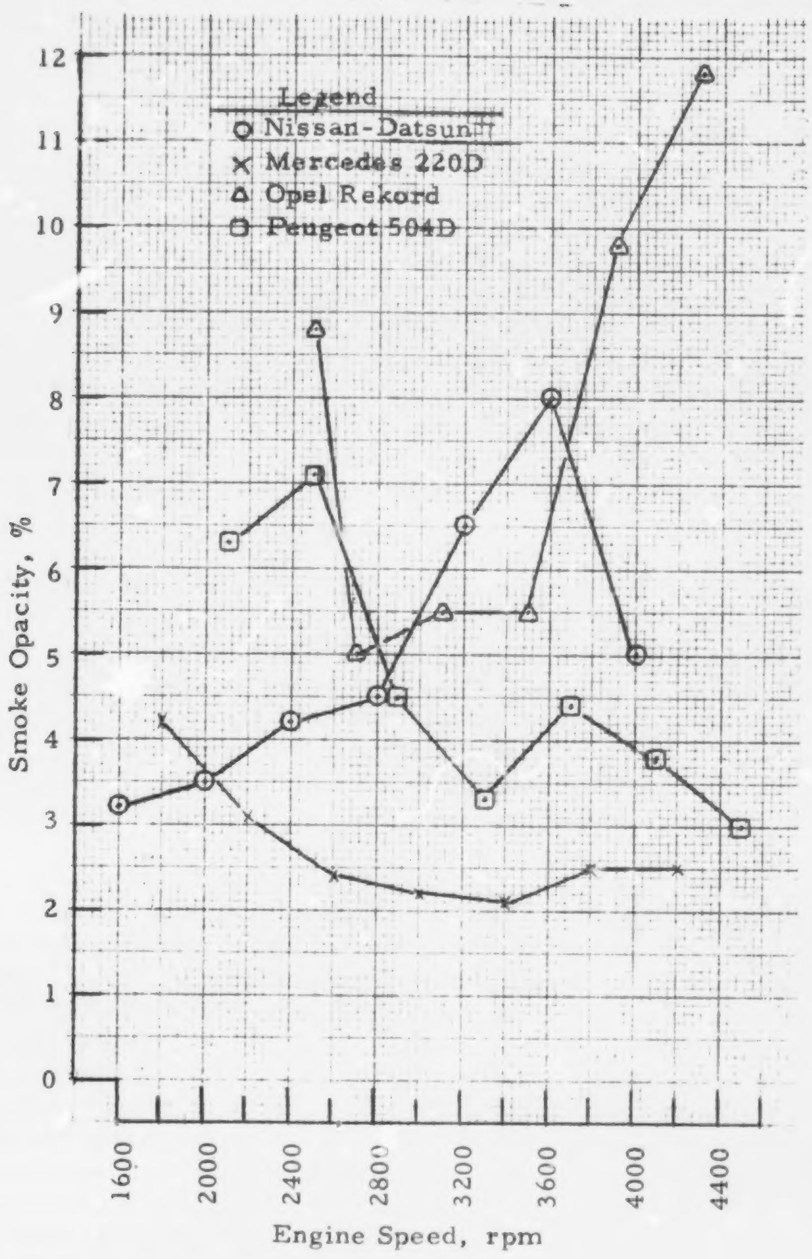

FIGURE 28. SMOKE OPACITY AT VARIOUS ENGINE SPEEDS UNDER MAXIMUM POWER OUTPUT CONDITIONS

visual judgmental basis since no specific procedure has yet been developed or suggested using such a transient, mostly light duty schedule. A well designed diesel engine will not smoke appreciably until the last 10 to 15 percent of power demand, something that infrequently happens on the LA-4 test even for the relatively low power to weight diesel powered cars tested.

Table 21 is a listing of smoke values in percent opacity considered important from a visual analysis of the traces. It was decided to look for those conditions which might produce maximum noticeable smoke during the cold as well as the hot start portion of the test. Since three tests were made, three sets of readings are listed for each segment of the LA-4 route evaluated. Table 21 starts with the initial cold start which, for the diesel, usually results in a momentary peak value from 20 to 75 percent. Next, the cold idle which occurs immediately after start produced negligible levels except for a couple of runs with the Mercedes which seemed to smoke more at idle than the other cars. This was noted throughout the test at each idle. The TCCS, operating on diesel fuel, emitted smoke on the order of 7 percent opacity during the initial cold idle.

Next, the initial accel with the still cold engine was rated for its peak or maximum smoke level recorded. Each vehicle and engine responded differently with the Opel producing some very sharp spikes up to 40 percent opacity. The duration of this peak was very short, hence the work "spike". It is noticeable for a very brief period of less than 1 second. The Mercedes consistently produced peak opacities during this initial accel in the range of 16 to 23 percent. The TCCS, operating on diesel fuel, consistently produced peak opacities on the order of 60 to 75 percent.

An interesting part of the entire 23-minute LA-4 driving pattern occurs during the first 505 seconds or first bag. Starting at 164 seconds of the test, the vehicle is accelerated from rest to 90.1 km/hr (56 mph) The vehicle undergoes an upshift during this acceleration and for the low power to weight ratio diesel cars, requires generally maximum power or close to maximum power from the engine. In a sense, this accel is similar to the two accels in the EPA HD smoke test procedures. Shown on Table 21 is the average smoke during the idle just prior to the acceleration and the maximum or peak opacity recorded during acceleration to 90.1 km/hr (56 mph). The idle results are quite similar to that during cold idle except the Mercedes which was more consistent with other idles later in the 23-minute test. The TCCS, diesel fueled, smoke was about half the initial cold idle.

The accel peak smoke for the five cars is the maximum value measured by the smokemeter and in some instances represented a very brief spike. Some of these peak values occurred twice during the accel and represented the two requirements for power during the speed time trace. In general, the peaks were broader and more sustained than that common to starting with an occasional spike, short puff, on top of the smoke trace proper.

Figures 29 to 36 are typical cold start idle-accel to 90. 1 km/hr (56 mph) for each of the five cars. The trace represents the first 300 seconds of the cold start and was considered typical. For Figures 29-33, run number 2 was selected which in the case of the Peugeot was the first set and for the Opel, the last set of data on Table 21. Run 3 was selected for the Honda CVCC and gasoline fueled TCCS while run 1 was used for the TCCS fueled with diesel. The Nissan, Mercedes, Peugeot, Opel, and Capri PROCO charts were run at 0. 1 m/min chart speed with 100 percent of chart equal to 96. 5 km/hr (60 mph) except the Capri PROCO, Figure 33, which was 50 percent of chart. The TCCS and Honda tests were made at 0. 1524 m/min chart speed. The engine speeds shown on Figures 30 and 31 were equivalent to 5000 rpm full scale or 100 percent.

The smoke trace indicates opacity from 100 percent of chart equal to zero percent opacity to zero percent of chart equal to 100 percent opacity. In analyzing the smoke traces on Figures 29-33, careful attention must be paid the physical distance between recorder pens (offset) since a six-pen overlapping recorder was used. Contrary to what some charts show, acceleration of the engine, vehicle, and smoke output occurred essentially at the same time. Incidentally, each major chart division from right (engine start) to left is 10 mm and is equal to six seconds on Figures 29-33. On Figures 34-36, each major chart division is 25. 4 mm and equal to 10 seconds.

Continuing with the discussion of these smoke traces, Table 21 lists the hot start peak opacity subsequent idle average opacity readings taken after the prescribed 10 minute soak. For one engine, the Nissan, the hot start smoke peak was much lower than its cold start, while for the other three diesel cars, there was some improvement but the peak was still substantial and easily noticeable. The hot start TCCS and Honda CVCC was higher, about double the cold start opacities. The hot start idle readings basically replicated the cold idle values except the diesel fueled TCCS which was much lower for some reason. The first accel in the LA-4 hot start test was a repeat of the earlier cold start first accel in the driving procedure. The peak smoke was, however, definitely lower for all diesel fueled cars. The Mercedes, Peugeot, Opel, and TCCS diesel all showed measurable improvement and this may be attributed to the engine being in a warm condition.

The next condition rated was the idle just prior to the acceleration to 90. 1 km/hr (56 mph) which repeated the same type of idle but during the cold start part of the test. Then, as now, the Mercedes for

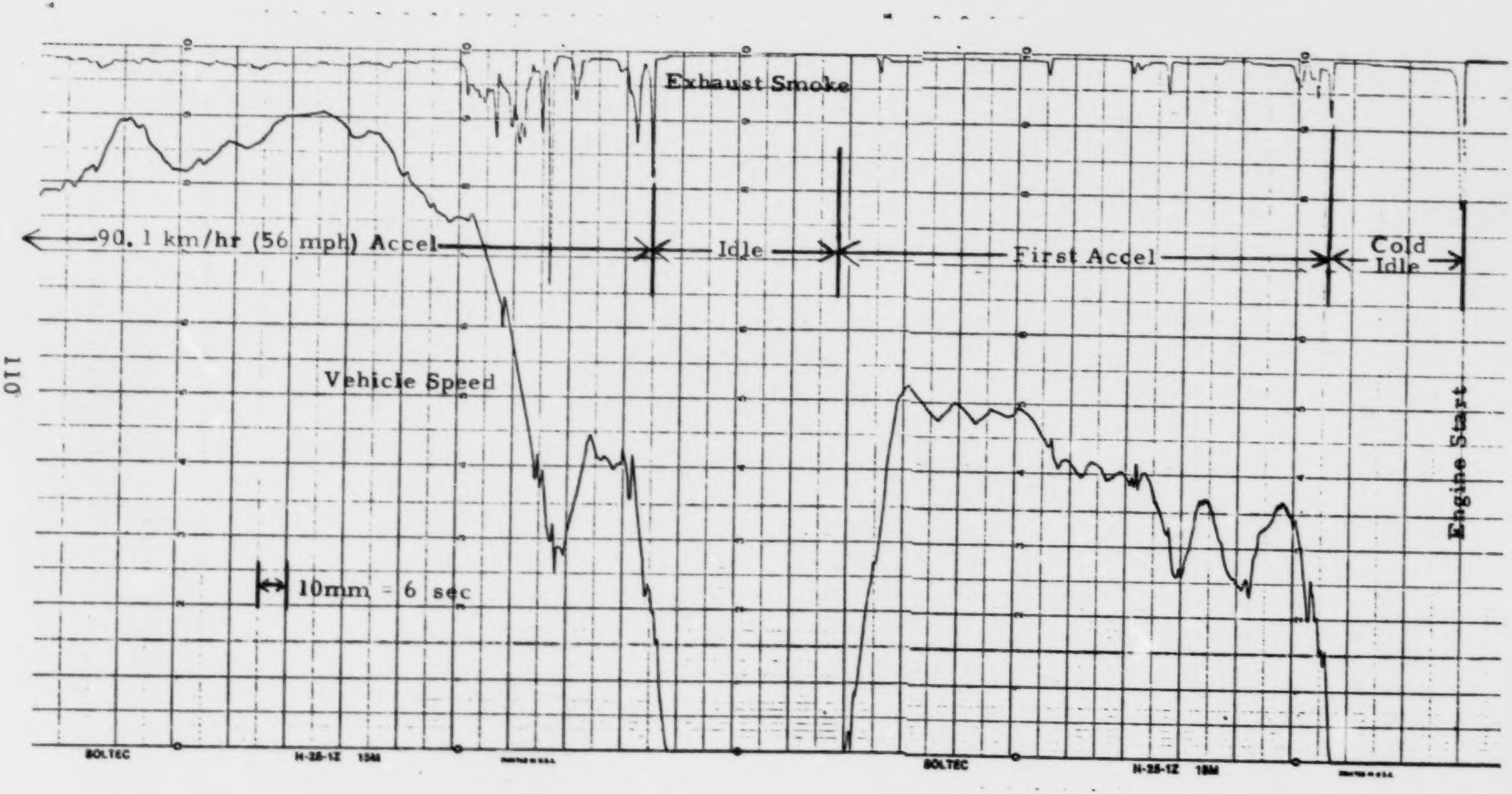

FIGURE 29. TYPICAL NISSAN-DATSUN DIESEL CAR "COLD-START" SMOKE TRACE (First 300 Seconds of 1975 FTP)

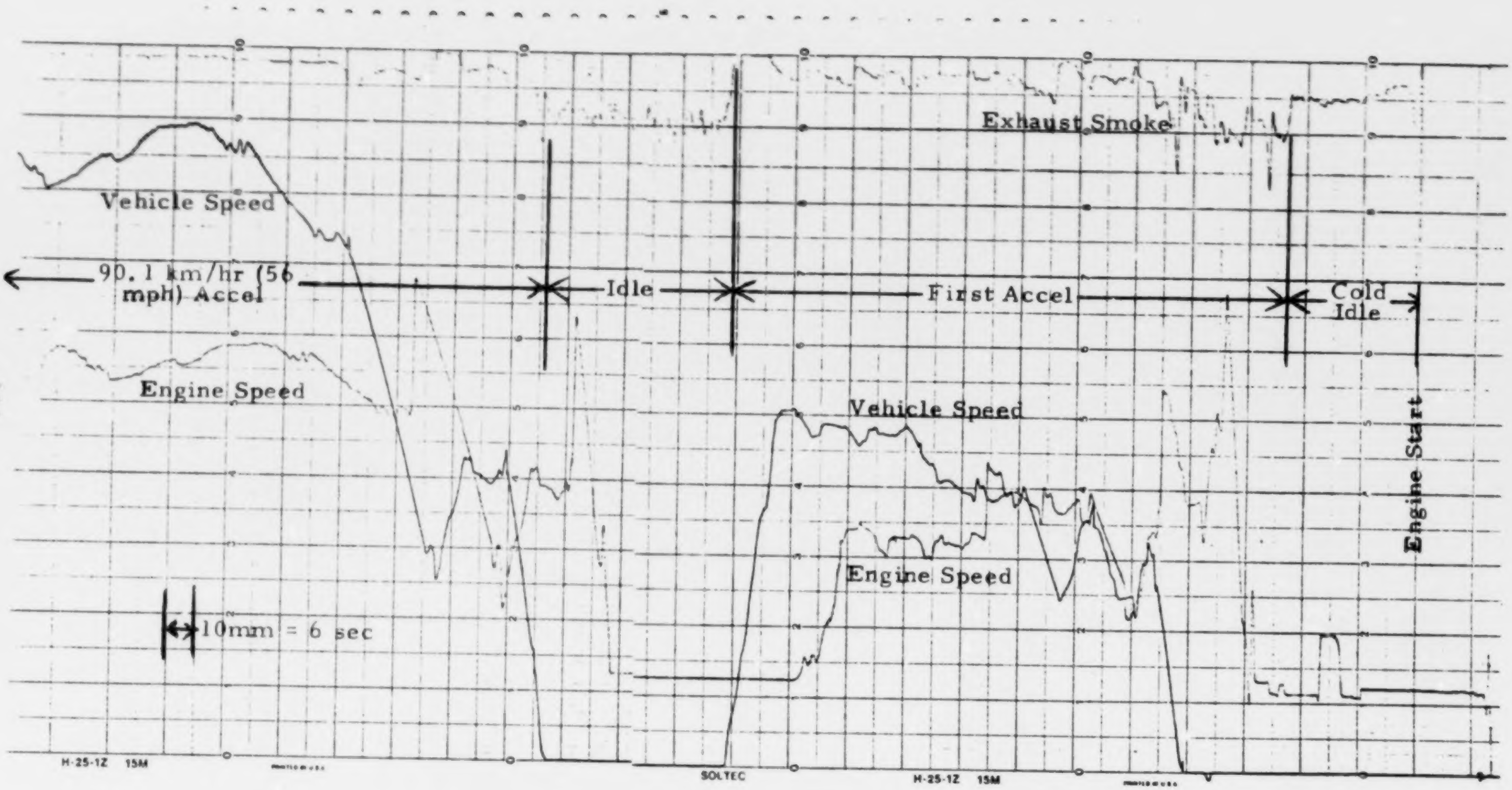

FIGURE 30. TYPICAL MERCEDES 220D DIESEL CAR "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

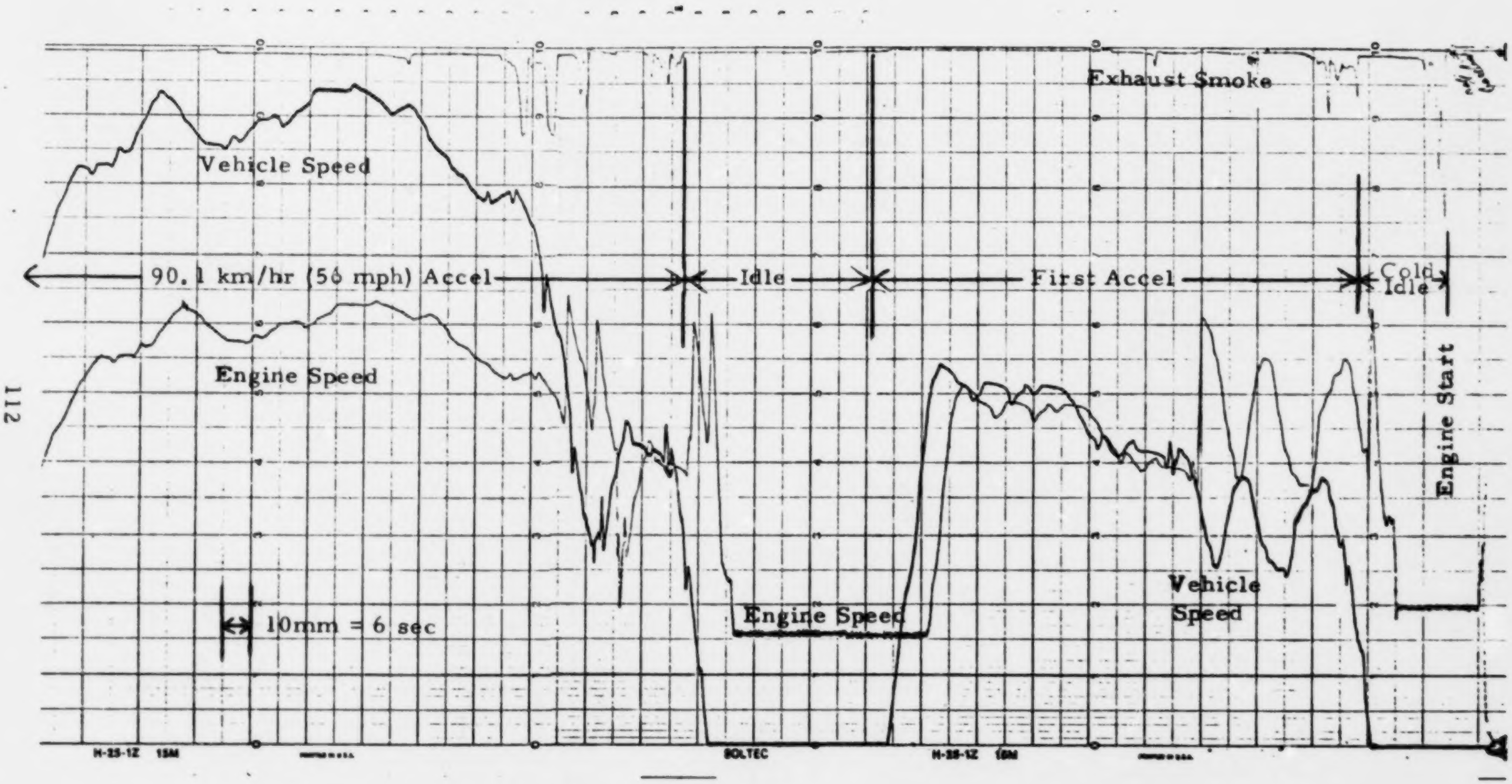

FIGURE 31. TYPICAL PEUGEOT 504D DIESEL CAR "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

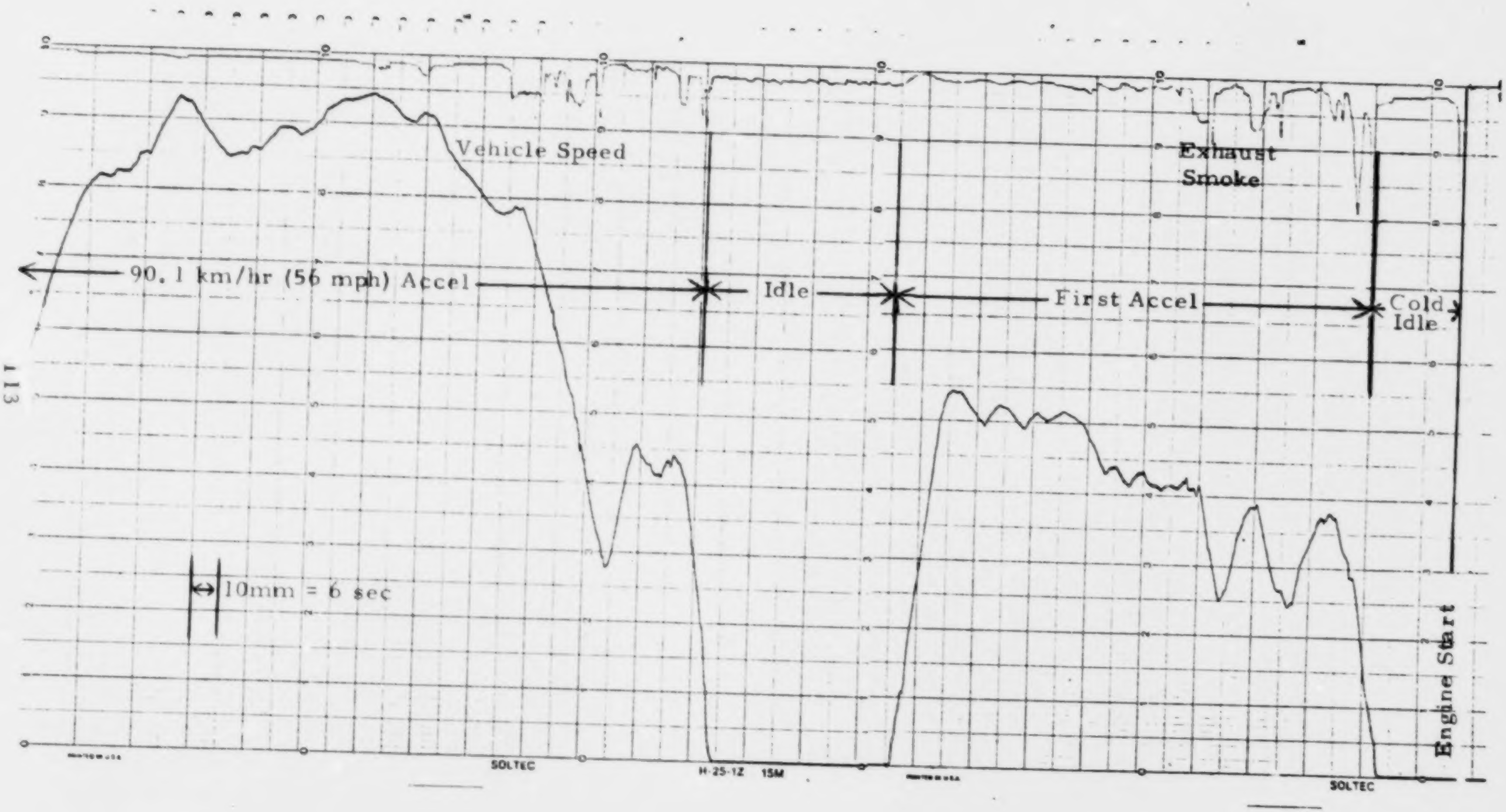

FIGURE 32. TYPICAL OPEL REKORD DIESEL CAR "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

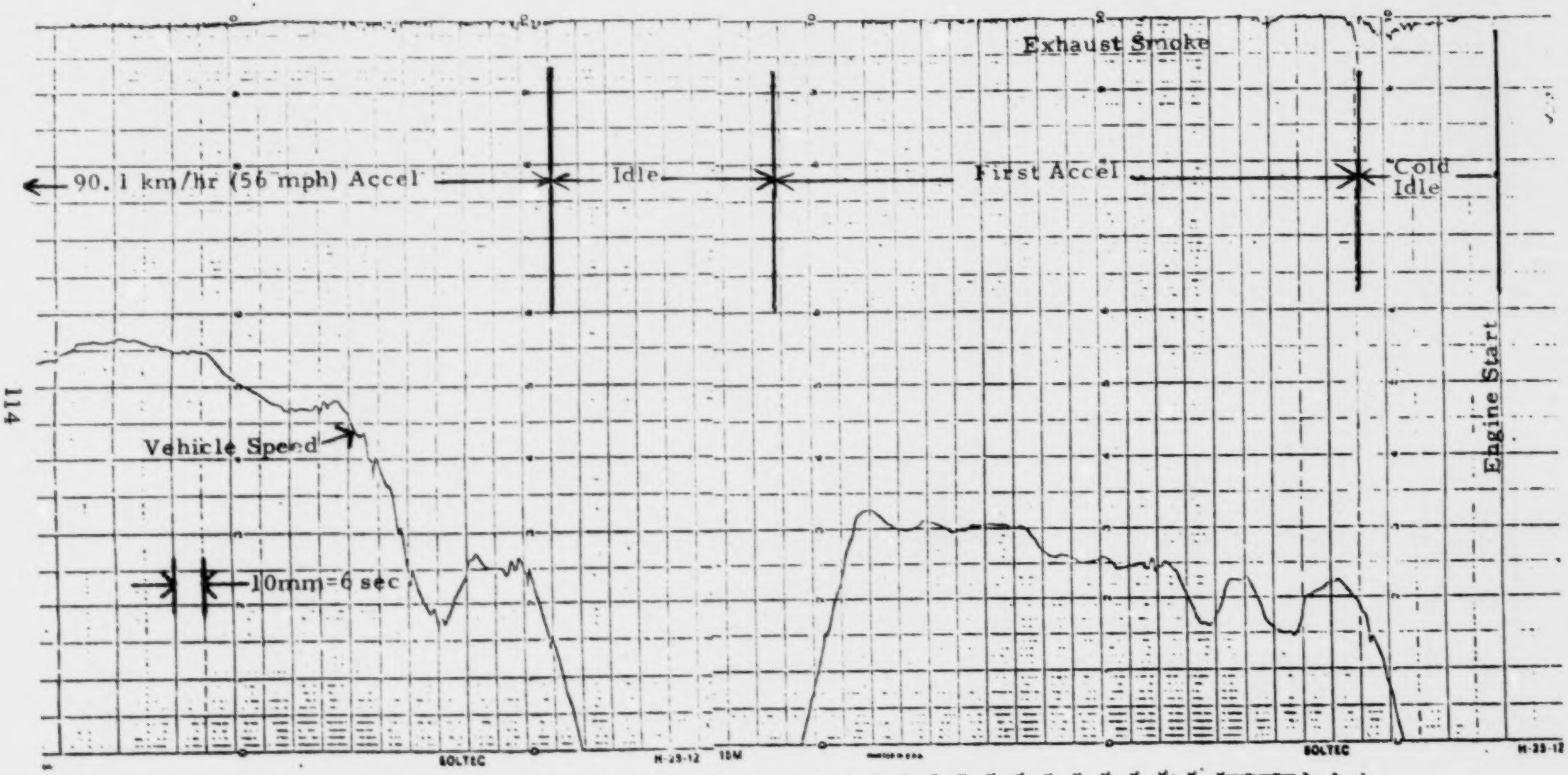

FIGURE 33. TYPICAL FORD CAPRI PROCO "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

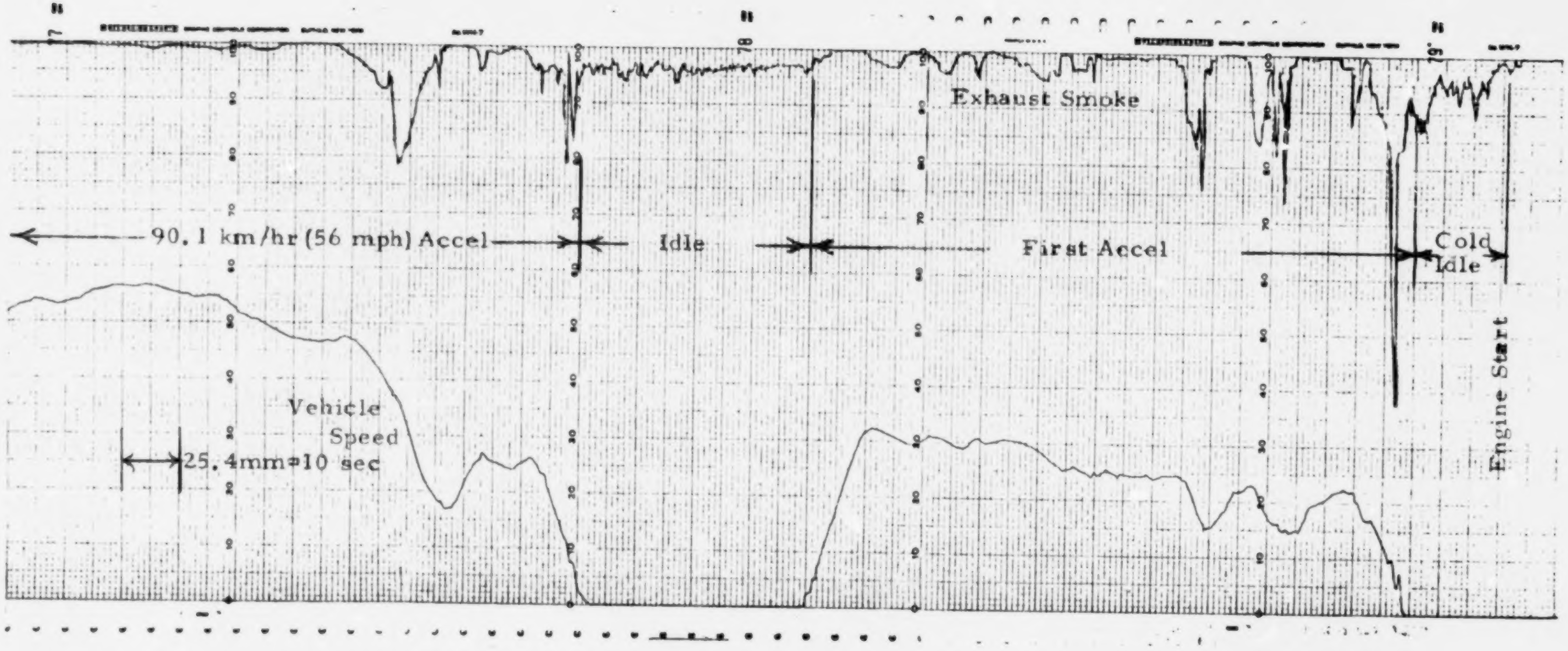

FIGURE 34. TYPICAL DIESEL CRICKET TCCS "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

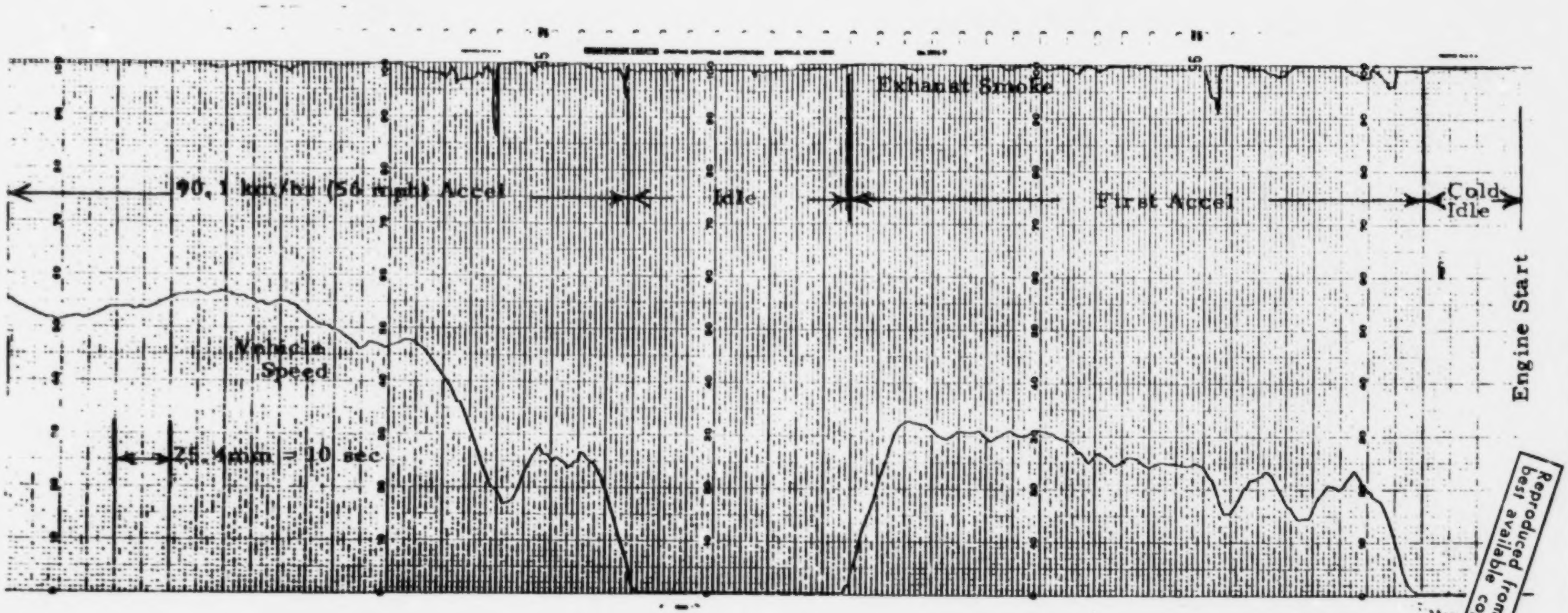

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FIGURE 35. TYPICAL GASOLINE CRICKET TCCS "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

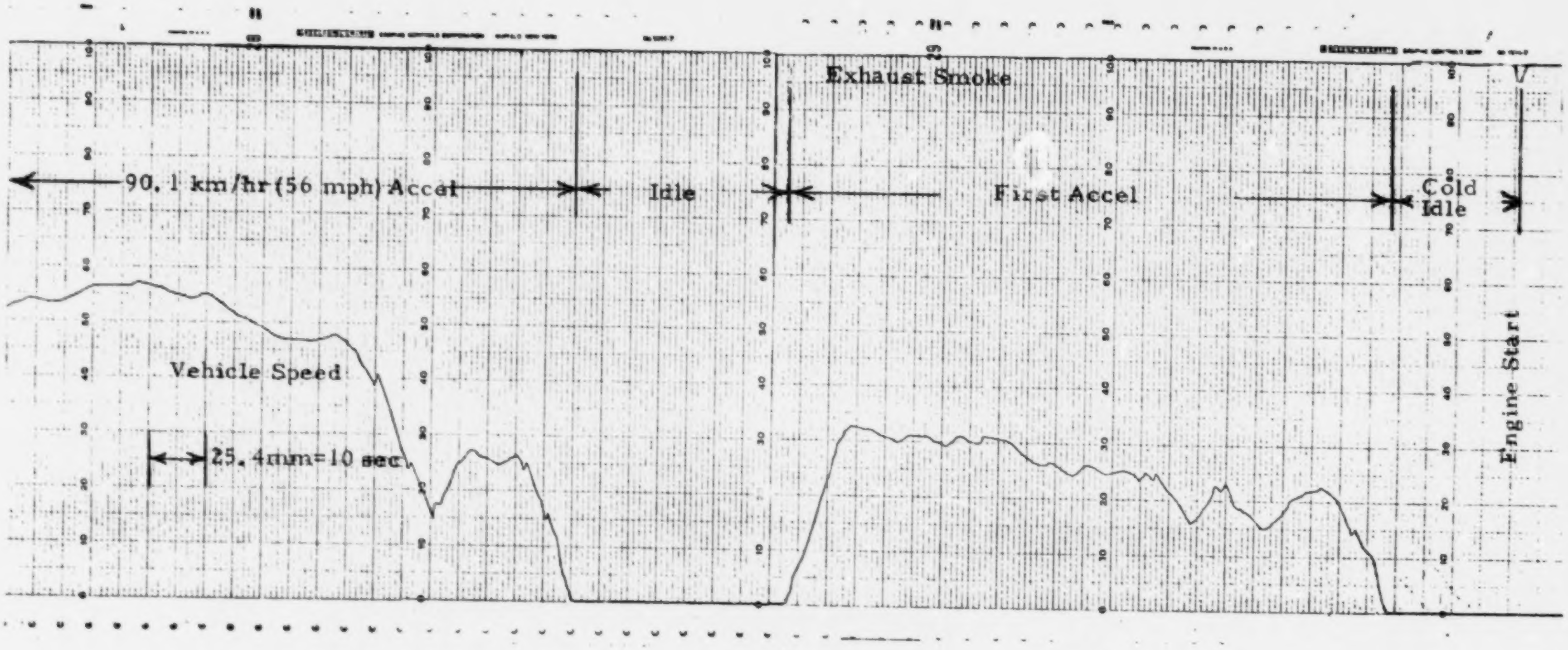

FIGURE 36. TYPICAL GASOLINE HONDA CVCC "COLD-START" SMOKE TRACE
(First 300 Seconds of 1975 FTP)

some reason demonstrated a much higher idle smoke on the order of 8 to 12 percent, which is easily noticeable. These idle values may be compared to those for the Mercedes recorded soon after start either hot or cold. The higher idle smoke of the Mercedes 220D found during the warm stabilization portion of the LA-4 test are of some concern since this represents an important part of urban operation and could give rise to complaints. The curious thing is the smoke increased to about 10 percent opacity at idle after the engine had run for a short time and was consistent thereafter. It is also curious that under highly loaded conditions such as the 1974 FTP for HD, the smoke was substantially lower, 3.3 percent "a" factor and 2.7 percent "b" factor from Table 19.

The rapid accel to 90.1 km/hr (56 mph) during the final 505 seconds resulted in peak opacities that were substantially lower than the same driving sequence performed when the engine was cold. This was true for all diesel cars tested except the Mercedes 220D which was found to be about the same. The gasoline and diesel fueled TCCS continued to exhibit relatively high acceleration peak opacities though somewhat lower than during the 90.1 km/hr accel of the cold 505 second run.

Listed on the bottom of Table 21 are visual estimates of the time average smoke percent opacity for the first 505 seconds of the cold start, the remainder of the first 23-minute test, and the 505 second hot start after 10 minute soak, and an overall judgment about the entire 1975 LA-4 test. For all cars, except the Mercedes and diesel fueled TCCS, the overall smoke was below the visibility limit taken as 3 to 4 percent opacity by the U. S. PHS smokemeter. The repeated idles and their 8 to 12 percent levels, made the average opacity for the Mercedes 220D higher than it would otherwise have been. The estimated 6 percent opacity shown for the Mercedes by the LA-4 is about double that measured during the HD test of 3.3 percent "a" and 2.7 percent "b" factor. It is interesting to note the FTP for HD smoke does not include measurement of opacity at engine idle. Practically all engines have no idle smoke except after cold start or after a very prolonged cold idle which produces a white smoke. The Mercedes idle smoke was grayish black and not "cold smoke". The diesel fueled TCCS had sufficient idle and acceleration smoke to result in the overall rating of 4.5 percent which is at or just above the limit of visibility.

The fifth car listed on Table 21 was the stratified charge Capri PROCO. This gasoline powered car demonstrated very low smoke throughout the entire 1975 FTP LA-4 driving sequence including cold start, idle and acceleration. This set of measurements attests to the invisible smoke from most gasoline cars. The sixth car listed on Table 21 was the gasoline fueled TCCS which emitted more smoke during engine start and accelerations than expected. The peak opacities were transient in nature but yet noticeable and not as low as other

TABLE 21. SMOKE OPACITY VALUES FROM SMOKE TRACE DURING 1975 FTP LA-4 COLD - HOT START

Smoke Condition	Nissan Datsun	Mercedes 220D	Peugeot 504D	Opel Rekord	Capri PROCO	Texaco TCCS		Honda CVCC
						Diesel	Gasoline	
Cold Start, peak %	45.0	24.0	24.0	77.5	0.2	5.1	5.5	5.1
	21.0	29.5	20.0	77.5	2.2	2.5	6.0	5.0
	44.5	25.0	41.0	70.5	1.5	4.8	5.5	3.0
Cold Idle, avg %	1.0	2.5	1.0	2.0	0	7.5	0.2	0.2
(After Start)	1.0	5.5	0.3	1.5	0.5	7.5	0.0	0.2
	1.0	7.5	1.0	2.0	0.8	7.0	0.3	0.0
1st Accel, peak %	6.5	16.0	9.0	38.5*	0.8	77.5	12.0	0.8
(After Cold Idle)	8.0	17.5	21.0	22.0	0.6	63.0	4.0	1.2
	4.0	23.0	6.5	44.5*	0.9	61.3	7.2	0.5
Idle at 125 sec, avg %	0.5	10.0	0.8	3.0	0.2	4.0	2.5	0.2
	0.5	10.0	1.0	2.5	0	4.0	1.0	0.3
	0.5	11.0	1.0	2.5	0.2	3.5	1.0	0.0
Accel at 164 sec, peak %	11.5	11.0	13.0	18.0*	2.1	21.4	17.0	2.1
to 90.1 km/hr (56 mph)	34.0*	5.5	17.5	7.5	1.5	21.6	5.0	2.1
	14.5	7.0	12.0	9.0	1.5	28.1	13.7	1.1
Hot Start, peak %	1.0	23.5	27.5	57.0	1.6	5.0	9.2	13.5
	1.0	23.0	25.0	69.5	0.3	9.0	17.1	10.2
	1.0	20.0	30.0	59.5	3.0	11.1	12.5	2.6
Hot Idle, avg %	0.5	2.0	1.5	1.5	0.3	0.2	0.0	0.0
(After Start)	0.3	2.0	1	0.5	0.2	0.0	0.0	0.0
	0.8	2.0	0.5	1.5	0.6	0.0	0.1	0.1
1st Accel, peak %	3.0	10.0	3.0	19.5*	0.8	31.1	15.5	0.0
(After Hot Idle)	2.5	10.5	3.0	9.5	0.6	32.2	5.5	0.1
	2.5	9.0	2.5	4.5	0.9	10.2	9.5	0.1
Idle at 125 sec, avg %	0.3	12.0	1.0	2.5	0.2	4.0	2.5	0.0
(During Final 505 sec)	0.8	10.0	1.0	2.5	0.2	1.0	2.5	0.0
	0.2	8.0	0.5	2.0	0.6	4.5	2.3	0.0
Accel at 164 sec, peak %	7.0	8.0	7.0	5.5	1.0	14.0	8.2	0.2
to 90.1 km/hr (56 mph)	10.0	8.5	7.5	12.0	0.8	16.0	10.0	0.2
(During Final 505 sec)	6.0	7.5	6.5	7.0	1.1	22.0	13.5	0.2
Estimated Average, %	3.5	7.5	2.5	3.0	0.7	5.5	2.5	0.2
During First 505 sec	4.5	6.0	3.5	2.5	0.7	5.5	1.0	0.3
(Cold Start)	4.0	7.0	3.0	3.5	0.8	4.5	1.7	0.2
Estimated Average, %	2.5	6.5	2.0	1.5	0.6	3.5	1.7	0.2
During Remainder of 23 min	3.0	5.5	2.0	1.5	0.4	4.0	1.0	0.3
(Warm Stabilization)	2.5	6.0	2.0	2.5	0.5	3.5	1.2	0.1
Estimated Average, %	3.0	5.5	2.0	2.0	0.4	4.0	7.1	0.2
During Last 505 sec	3.0	6.0	2.0	2.0	0.3	4.0	1.5	0.2
(Hot Start)	3.0	5.5	2.0	3.0	0.5	3.5	1.8	0.1
Estimated Average, %	3.0	6.5	2.0	2.0	0.5	4.5	2.0	0.2
Entire 1975 LA-4	3.5	6.0	2.5	2.0	0.5	4.5	1.2	0.3
	3.5	6.0	2.5	3.0	0.6	4.0	1.6	0.1

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*Spike

gasoline powered vehicles. The last car, the Honda CVCC, also operated on gasoline, produced negligible smoke throughout the test sequence. The only exception was the peak during engine start which was found to be higher during the start after the ten-minute soak than during the initial cold start.

None of the five diesel fueled cars tested in this project could consistently produce exhaust with the extremely low levels of the Honda CVCC or Capri PROCO tested. Some of the diesels showed promise as far as being low smoke and having essentially an invisible exhaust But, if the smoke opacity may be considered a gross indicator of the exhaust particulate, then the diesel fueled car indeed has a way to go to match the gasoline in particulate if the test of these seven cars, one with diesel and gasoline, can be considered any indicator.

E. Vehicle Noise

Table 22 summarizes the noise measurements made on the entire group of cars with the exception of the Ford LTD. The data is listed in three groups by when they were tested. The first group consisted of the Nissan, Mercedes, and standard Capri, and was evaluated on March 5 and 6, 1974. The second group of cars, tested on March 26, 1974, included the Peugeot and Opel diesels, the PROCO Capri, and the standard Capri. The standard Capri was used as a "reference car" in both of these test groups. The last group included the Texaco TCCS operated on gasoline and diesel fuels, and the Honda CVCC. They were tested on August 13, 1974.

The SAE Standard J986a recommends the sound level produced by a new passenger car or light truck of 2722 kg (6000-lb) GVW or less shall not exceed 86 dB on the A-weighted scale. The highest exterior noise level recorded by this procedure was 77 dBA for the Mercedes 220 diesel during a right to left acceleration according to J986a. This is substantially below the 86 dBA of the SAE practice and must be termed quiet. Incidentally, this sound level was identical to that recorded three years earlier by a similar but different car operating over the same test course and under the same procedure(31). A different test crew and sound meter were used. The other cars were all less than 77 dBA as shown by the first line of results on Table 22. The Nissan was the next highest diesel and the Opel had the lowest sound level of the four diesels by this method.

The PROCO engine powered Capri was 76 dBA by the J986a test which may be compared directly to the four diesels and the standard Capri. The PROCO engine evidently resulted in 3 dBA higher exterior sound level when compared to the nominal 73 dBA rating for the unmodified 4 cylinder engine conventional Capri car. Note the close agreement between the test results on the standard Capri of 73 dBA on

TABLE 22. SUMMARY OF SOUND LEVEL MEASUREMENTS FOR DIESEL AND GASOLINE POWERED CARS - dBA SCALE

	Nissan Datsun	Mercedes 220D	Capri Std.	Peugeot 504D	Opel Rekord	Capri PROCO	Capri Std.	Cricket TCCS		Honda CVCC
								Diesel	Gasoline	
Date Tested	3-6-74	3-5-74	3-6-74	3-26-74	3-26-74	3-26-74	3-26-74	8-13-74	8-13-74	8-13-74
SAE J986a										
Accel Driveby										
Exterior	74.8	77	73	70.8	67.5	76	73.3	67	66.8	72.5
Interior										
Blower On(1)	84	78.8	82.3	80	73.8	83	83	76.8	75	82.3
Off	83.3	74.3	81.5	78.5	73.5	83	82.5	76	75	81.8
48.3 km/hr Driveby										
Exterior	63.3	62(2)	58.1(2)	61.3	62.5	58.5	58	59.8	59.8	56.5
Interior										
Blower On(1)	71.3	73.5	70.5	72.3	70	72.3	71.8	74	72.5	75
Off	69.5	63.5	65.8	66.5	69	70.5	66.5	73.3	72.5	75
Engine Idle										
Exterior(3)	79	66	63	68	72	63.5	57.5	72	70.5	58.5 65(4)
Interior										
Blower On(1)	67	71.5	70	70	70	71	70.5	66	66.5	73.5
Off	66.8	51.5	54	52.3	53.3	66	53	62.5	65	49

(1) Windows Up, Fresh Air Blower on High
(2) at 7.62 m
(3) at 2.54 m
(4) Engine fan on

March 6, 1974, and 73.3 dBA on March 26, 1974. The driveby levels for the Cricket and Honda were 67 dBA and 72.5 dBA respectively.

The remainder of the noise tests were performed using procedures developed for the Federal Clean Car Incentive Program(31) described in Section III.D. of this report. The interior and exterior measurements are also summarized on Table 22. The highest interior measurements were always found with the fresh air ventilation blower in its highest position. Windows were up and radio was off. The noise of this blower and air distribution system added a negligible amount to the interior measurement during the J986a acceleration. The Mercedes 220D had the highest apparent blower noise difference of 4.5 dBA.

During the relatively quiet drive-by at a constant 48.3 km/hr (30 mph) the blower affected the interior noise level in varying degree as may be seen from Table 22. On some cars, notably the Nissan, Opel, PROCO, Cricket and Honda, the blower had only a small incremental effect, while on the Mercedes, Peugeot and standard Capri, the interior noise level was governed to a large extent by this item. It is especially noted from the very quiet interior levels with the Mercedes of 63.5 dBA with blower off to 73.5 dBA with blower on "high". These differences are pointed out to indicate the basically quiet interior as well as exterior sound levels of all the cars during the cruise operation.

Engine idle is a point of concern with diesel engines from a noise standpoint. Table 22 also lists the results of exterior and interior measurements made with the car at rest. The maximum exterior idle noise measurement is given based on a 2.54m (10 ft) distance from each side, front and rear, of the vehicle. The highest engine idle exterior values recorded were in front (center) of the Nissan, Opel, and Peugeot diesel cars. The front and left side of the Mercedes gave equally high values while the Capri gasoline cars registered their highest ratings at the rear of the vehicle.

The diesel car exterior idle noise was higher than the gasoline cars and has to be attributed to the engine compartment. The Cricket TCCS exterior idle noise values were found to be on the order of the Opel diesel and not as quiet as the other stratified charge cars evaluated. It is interesting that the slightly higher noise levels for the TCCS operating on diesel fuel, relative to gasoline, were noticed by the test technicians. Another item of note was the effect of the Honda CVCC engine radiator cooling fan, an electric drive unit, which when idling, added substantially to the idle noise level by changing the level from 58.5 to 65 dBA. Further identification of noise sources whether fan, engine, or engine accessories, requires a more in-depth noise survey and analysis.

The interior noise levels during idle were greatly affected by the ventilation air blower system and followed the same trends discussed during the steady state cruise interior measurements. The very quiet Mercedes interior during idle of 51.5 dBA was increased to 71.5 dBA, about the same as during the cruise of 73.5 dBA. In this specific case, the blower noise was likely masking other noise sources in the vehicle including the diesel engine. The blower off data for the Mercedes does show, however, that a diesel-powered car can be made as quiet or even quieter than a gasoline car as shown by the comparison with the standard Capri. The interior idle values of the Honda CVCC were very low, 49 dBA, until the fresh air blower was turned on high and then 73.5 dBA was registered. The interior noise levels may be compared to the current OSHA limit of 90 dBA for 8 hour exposure.

Appendix I contains the replicate sound level measurement data for each car tested. Each table contains the complete test data for a given car and they are arranged in the order listed from left to right in Table 22. Please refer to this appendix for additional test detail.

In summary of this section, the four diesel and three stratified charge cars were found to have varying exterior/interior noise levels depending on the test condition and whether or not the fresh air blower is on "high" or "off" (interior measurements only). These measurements continue to demonstrate that diesel cars are not necessarily noisy or noisier than conventional gasoline powered cars. Some diesels were higher and some lower than the reference gasoline car during the SAE J986a acceleration test. Exterior idle measurements indicate engine compartment noise to be definitely higher from the diesel and the TCCS powered Cricket than the gasoline reference car. The Honda CVCC exterior idle noise was increased when the electric drive radiator was in operation. Driveby exterior levels at 48.3 km/hr (30 mph) show the diesel cars to be 3 to 5 dBA higher than the reference standard gasoline car. These differences are ostensibly attributed to the engine compartment and engine proper although specific survey data of noise sources, other than the fresh air system, have not been evaluated in this project.

LIST OF REFERENCES

1. Springer, Karl J., "Emissions from a Gasoline- and Diesel-Powered Mercedes 220 Passenger Car," Report No. AR-813, Contract No. CPA 70-44, June 1971.

2. Ashby, H. Anthony, "Exhaust Emissions from a Mercedes-Benz Diesel Sedan," Final Report, July 1972.

3. Springer, Karl J., and Ashby, H. Anthony, "The Low Emission Car for 1975 - Enter the Diesel," Paper No. 739133, Intersociety Energy Conversion Engineering Conference, August 1973.

4. Federal Register, Volume 38, Number 151, Part III, August 7, 1973.

5. Springer, Karl J., "An Investigation of Diesel-Powered Vehicle Odor and Smoke - Part I," Final Report to the U. S. Public Health Service, Contract PH 86-66-93, March 1967.

6. Springer, Karl J. and Stahman, Ralph C., "An Investigation of Diesel Powered Vehicle Odor and Smoke," National Petroleum Refiners Association, FL 66-46 presented at the Fuels and Lubricants Meeting, Philadelphia, Pennsylvania, September 1966.

7. Springer, Karl J., "An Investigation of Diesel-Powered Vehicle Odor and Smoke, Part II," Final Report, No. AR-644, Contract PH 86-67-72, February 1968.

8. Stahman, Ralph C., Kittredge, George, and Springer, Karl, "Smoke and Odor Control for Diesel-Powered Trucks and Buses," SAE Paper No. 680443, Mid-Year Meeting, Detroit, Michigan, May 20-24, 1968. Also SAE Transactions.

9. Springer, Karl J., "An Investigation of Diesel-Powered Vehicle Odor and Smoke - Part III," Final Report to the U. S. Public Health Service, Contract PH 22-68-23, October 1969.

10. Springer, Karl J. and Harry E. Dietzmann, "An Investigation of Diesel-Powered Vehicle Odor and Smoke - Part IV," Final Report to the Environmental Protection Agency, Contract PH 22-68-23, April 1971.

11. Springer, Karl J. and Charles T. Hare, "Four Years of Diesel Odor and Smoke Control Technology Evaluations - A Summary," ASME Paper No. 69-WA/APC-3, November 1969.

LIST OF REFERENCES (Cont'd.)

12. Dietzmann, Harry E., Springer, Karl J., and Stahman, Ralph C., "Diesel Emissions as Predictors of Observed Diesel Odor," SAE Paper No. 720757, September 1972. Also SAE Transactions.

13. Springer, Karl J. and Dietzmann, Harry E., "Diesel Exhaust Hydrocarbon Measurement - A Flame Ionization Method," SAE Paper No. 700106, January 1970.

14. Springer, Karl J., "An Investigation of Diesel-Powered Vehicle Emissions - Part V," Final Report AR-936 to Environmental Protection Agency, Contract PH 22-68-23, April 1974.

15. Springer, Karl J. and Hare, Charles T., "A Field Survey to Determine Public Opinion of Diesel Engine Exhaust Odor," Final Report to the National Air Pollution Control Administration under Contract PH 22-68-36, February 1970.

16. Hare, Charles T. and Springer, Karl J., "Public Response to Diesel Engine Exhaust Odors," Final Report to the Environmental Protection Agency under Contract No. CPA 70-44, April 1971.

17. Hare, Charles T., Springer, Karl J., Somers, Joseph H., and Huls, Thomas A., "Public Opinion of Diesel Odor," SAE Paper No. 740214, presented at the Automotive Engineering Congress, Detroit, Michigan, February 25 - March 1, 1974.

18. "Guide to Reduction of Smoke and Odor from Diesel-Powered Vehicles," Office of Air Programs Publication No. AP-81, Environmental Protection Agency, September 1971.

19. Springer, Karl J. and Ludwig, Allen C., "Documentation of the Guide to Good Practice for Minimum Odor and Smoke from Diesel-Powered Vehicles," Final Report, Contract CPA 22-69-71, November 1969.

20. Federal Register, Volume 36, No. 40, February 27, 1971.

21. "Lead and Phosphorus Content of Unleaded Fuel for Certification Testing," MSAPC Advisory Circular No. 26-A, U. S. Environmental Protection Agency, August 10, 1973.

22. Bascom, R. C. and Hass, G. C., "A Status Report on the Development of the 1973 California Diesel Emissions Standards," SAE Paper No. 700671, National West Coast Meeting, Los Angeles, August 24-27, 1970.

LIST OF REFERENCES (Cont'd.)

23. State of California, Air Resources Board, "California Exhaust Emission Standards, Test and Approval Procedures for Diesel Engines in 1973 and Subsequent Model Year Vehicles over 6,001 Pounds Gross Vehicle Weight," amended February 17, 1971.

24. Turk, Amos, "Selection and Training of Judges for Sensory Evaluation of the Intensity and Character of Diesel Exhaust Odors," U. S. Department of Health, Education, and Welfare, Public Health Service, 1967.

25. Chemical Identification of the Odor Components in Diesel Engine Exhaust, Final Report, July 1969, CRC Project CAPE-7-68, HEW Contract PH 22-68-20.

26. Chemical Identification of the Odor Components in Diesel Engine Exhaust, Final Report, June 1970, CRC Project CAPE 7-68, HEW Contract No. CPA 22-69-63.

27. Chemical Identification of the Odor Components in Diesel Engine Exhaust, Final Report, June 1971, CRC Project CAPE 7-68, EPA Contract No. EHSD 71-18.

28. Analysis of the Odorous Compounds in Diesel Engine Exhaust, Final Report, June 1972, CRC Project CAPE 7-68, EPA Contract No. 68-02-0087.

29. Levins, P. L. and Kendall, D. A., "Application of Odor Technology to Mobile Source Emission Instrumentation," CRC Project CAPE 7-68, Contract No. 68-02-0561, September 1973.

30. Federal Register, Volume 33, No. 108, June 4, 1968.

APPENDIX A

COMPUTER REDUCED
1975 LIGHT DUTY FTP
GASEOUS AND FUEL ECONOMY DATA

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                    TABLE  A-2.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  009          TEST NO. 2            DATE  2/20/79
VEHICLE MODEL  NISSAN DIESEL                 ENGINE   2.17  LITRE 4         MFGR. CODE  380                 YR.  1973
                                                                            CURB WT.  1415 KG
                                                                            Test Weight  1588 kg
BAROMETER 731.27 MM OF HG.
DRY BULB TEMP.    27.2 DEG. C                                             WET BULB TEMP  18.3 DEG. C
REL. HUMIDITY      42 PCT.                                                 ABS. HUMIDITY   9.9 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                         1                2
     FINAL WT.,    GRAMS                            -0.00            -0.00
     INITIAL WT.,  GRAMS                            -0.00            -0.00
     DIFFERENCE    GRAMS                             0.00             0.00

     TOTAL EVAPORATIVE EMISSIONS                                                0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 188.0 MM. H2O                                BLOWER INLET PRESS., G1 167.6 MM. H2O
                                                                          BLOWER INLET TEMP.    40 DEG. C
     BAG RESULTS
     BAG NO.                                          1                2                3
     BLOWER REVOLUTIONS                             5380             9068             5376
     HC    SAMPLE  METER READING/SCALE              32.1/2           20.1/2           22.7/2
     HC    SAMPLE  PPM                                64               40               45
     HC    BACKGRD METER READING/SCALE               4.5/1            3.8/1            3.3/1
     HC    BACKGRD PPM                                 5                4                3
     CO    SAMPLE  METER READING/SCALE               6.8/3            5.2/3            6.6/3
     CO    SAMPLE  PPM                               102               70               99
     CO    BACKGRD METER READING/SCALE                .7/3             .3/3            0.0/3
     CO    BACKGRD PPM                                10                4                0
     CO2   SAMPLE  METER READING/SCALE              69.9/2           46.3/2           62.5/2
     CO2   SAMPLE  PERCENT                          2.07             1.29             1.83
     CO2   BACKGRD METER READING/SCALE               2.1/2            2.3/2            2.1/2
     CO2   BACKGRD PERCENT                           .05              .06              .05
     NOX   SAMPLE  METER READING/SCALE              25.2/3           17.5/3           23.1/3
     NOX   SAMPLE  PPM                              75.6             52.5             69.3
     NOX   BACKGRD METER READING/SCALE               1.3/3            1.0/3            1.0/3
     NOX   BACKGRD PPM                               3.9              3.0              3.0

     HC    CONCENTRATION PPM                          60               37               42
     CO    CONCENTRATION PPM                          88               71               99
     CO2   CONCENTRATION PCT                        2.02             1.24             1.78
     NOX   CONCENTRATION PPM                        72.3             49.8             66.7
     HC    MASS GRAMS                               1.45             1.49             1.02
     CO    MASS GRAMS                               4.26             5.77             4.55
     CO2   MASS GRAMS                            1549.10          1601.89          1362.12
     NOX   MASS GRAMS                               5.60             6.50             5.16

     WEIGHTED MASS HC        .22 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .85 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    252.28 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .98 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.6  KILOMETRE/LITRE
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TABLE A-3.          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                           1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  004          TEST NO. 3           DATE  2/21/74                  MFGR. CODE  380                  YR.  1973
VEHICLE MODEL  NISSAN DIESEL                ENGINE  2.17  LITRE 4          CURB WT.  1415 KG
                                                                           Test Weight 1588 kg

BAROMETER 740.16 MM OF HG.                                               WET BULB TEMP  12.8 DEG. C
DRY BULB TEMP.    22.2 DEG. C                                             ABS. HUMIDITY   5.4 MILLIGRAMS/KG
REL. HUMIDITY      32 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1           2
     FINAL WT.,    GRAMS                      -0.00       -0.00
     INITIAL WT., GRAMS                       -0.00       -0.00
     DIFFERENCE    GRAMS                       0.00        0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 193.0 MM. H2O                      BLOWER INLET PRESS., G1 170.2 MM. H2O
                                                                BLOWER INLET TEMP.   40 DEG. C
     BAG RESULTS
     BAG NO.                                     1            2            3
     BLOWER REVOLUTIONS                        5397         9197         5361
     HC    SAMPLE  METER READING/SCALE        33.9/2       17.1/2       17.2/2
     HC    SAMPLE  PPM                          68           34           34
     HC    BACKGRD METER READING/SCALE         .2/1         .1/1        0.0/1
     HC    BACKGRD PPM                           0            0            0
     CO    SAMPLE  METER READING/SCALE        5.5/3        3.6/3        5.2/3
     CO    SAMPLE  PPM                          82           64           78
     CO    BACKGRD METER READING/SCALE       0.0/3         .5/3         .7/3
     CO    BACKGRD PPM                           0            7           10
     CO2   SAMPLE  METER READING/SCALE       63.6/2       43.0/2       59.8/2
     CO2   SAMPLE  PERCENT                    1.86         1.19         1.73
     CO2   BACKGRD METER READING/SCALE        2.6/2        2.2/2        1.9/2
     CO2   BACKGRD PERCENT                     .06          .05          .05
     NOX   SAMPLE  METER READING/SCALE       24.7/3       16.9/3       23.2/3
     NOX   SAMPLE  PPM                        74.1         50.7         69.6
     NOX   BACKGRD METER READING/SCALE         .3/3         .1/3         .1/3
     NOX   BACKGRD PPM                          .9           .3           .3

     HC    CONCENTRATION PPM                    68           34           34
     CO    CONCENTRATION PPM                    78           45           65
     CO2   CONCENTRATION PCT                  1.81         1.14         1.69
     NOX   CONCENTRATION PPM                  73.3         50.4         69.3
     HC    MASS GRAMS                         1.69         1.41          .83
     CO    MASS GRAMS                         3.85         3.75         3.19
     CO2   MASS GRAMS                      1402.03      1498.93      1303.75
     NOX   MASS GRAMS                         5.03         5.87         4.73

     WEIGHTED MASS HC        .21 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .60 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    235.75 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.3  KILOMETRE/LITRE
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TABLE A-4             VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                           1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  009        TEST NO. 4           DATE  2/22/79                  MFGR. CODE  380              YR.  1973
VEHICLE MODEL  NISSAN DIESEL              ENGINE   2.17 LITRE 4          CURB WT.  1415 KG
                                                                          Test Weight  1588 kg

BAROMETER 744.81 MM OF HG.                                              WET BULB TEMP  11.7 DEG. C
DRY BULB TEMP.   24.4 DEG. C                                             ABS. HUMIDITY   3.2 MILLIGRAMS/KG
REL. HUMIDITY     17 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                      1              2
     FINAL WT.,    GRAMS                       -0.00          -0.00
     INITIAL WT.,  GRAMS                       -0.00          -0.00
     DIFFERENCE    GRAMS                        0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS

EXHAUST EMISSIONS

                                                                        BLOWER INLET PRESS., G1 178.7 MM. H2O
     BLOWER DIF. PRESS., G2, 193.0 MM. H2O                              BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                         1              2              3
     BLOWER REVOLUTIONS                           5673           9171           5396
     HC   SAMPLE  METER READING/SCALE           41.2/2         18.2/2         18.3/2
     HC   SAMPLE  PPM                               82             36             37
     HC   BACKGRD METER READING/SCALE            6.3/1          6.1/1          5.1/1
     HC   BACKGRD PPM                                6              6              5
     CO   SAMPLE  METER READING/SCALE            9.3/3          9.8/3          6.1/3
     CO   SAMPLE  PPM                              140             78             91
     CO   BACKGRD METER READING/SCALE            0.0/3          0.0/3          0.0/3
     CO   BACKGRD PPM                                0              0              0
     CO2  SAMPLE  METER READING/SCALE           66.9/2  [illegible].5/2         62.2/2
     CO2  SAMPLE  PERCENT                         1.94   1.3[illegible]          1.82
     CO2  BACKGRD METER READING/SCALE            2.9/2          2.3/2          1.9/2
     CO2  BACKGRD PERCENT                          .06            .06            .05
     NOX  SAMPLE  METER READING/SCALE           27.0/3         18.8/3         25.2/3
     NOX  SAMPLE  PPM                             81.8           56.9           75.6
     NOX  BACKGRD METER READING/SCALE             .2/3           .4/3          0.0/3
     NOX  BACKGRD PPM                               .6            1.2            0.0

     HC   CONCENTRATION PPM                         77             31             32
     CO   CONCENTRATION PPM                        139             69             88
     CO2  CONCENTRATION PCT                       1.89           1.25           1.77
     NOX  CONCENTRATION PPM                       80.5           55.3           75.6
     HC   MASS GRAMS                              1.99           1.29            .79
     CO   MASS GRAMS                              7.02           5.86           4.31
     CO2  MASS GRAMS                           1562.93        1665.69        1380.92
     NOX  MASS GRAMS                              5.55           6.16           4.41

     WEIGHTED MASS HC        .22 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .99 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    258.95 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .99 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.3  KILOMETRE/LITRE
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                 TABLE  A-5.            VEHICLE EMISSION RESULTS
                                    1975  LIGHT DUTY EMISSIONS TEST

UNIT NO. 004        TEST NO. 1         DATE  2/19/79                  MFGR. CODE  380                YR.  1973
VEHICLE MODEL  NISSAN DIESEL           ENGINE   2.17 LITRE 4          CURB WT.  1415 KG
                                                                      Test Weight:  1588 kg

BAROMETER 736.09 MM OF HG.                                          WET BULB TEMP  13.3 DEG. C
DRY BULB TEMP.   26.1 DEG. C                                         ABS. HUMIDITY   4.4 MILLIGRAMS/KG
REL. HUMIDITY     20 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,    GRAMS                    -0.00          -0.00
     INITIAL WT., GRAMS                     -0.00          -0.00
     DIFFERENCE    GRAMS                     0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                         0.00 GRAMS


EXHAUST EMISSIONS

                                                                    BLOWER INLET PRESS., G1 165.1 MM. H2O
     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                          BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                    1              2              3
     BLOWER REVOLUTIONS                      5538           9097           5960
     HC   SAMPLE  METER READING/SCALE       4.2/2          2.8/3          3.4/3
     HC   SAMPLE  PPM                          42             28             34
     HC   BACKGRD METER READING/SCALE       1.4/3          1.4/3          1.1/3
     HC   BACKGRD PPM                          14             14             11
     CO   SAMPLE  METER READING/SCALE       7.8/3          5.5/3          6.7/3
     CO   SAMPLE  PPM                         117             82            100
     CO   BACKGRD METER READING/SCALE        .3/3          0.0/3           .1/3
     CO   BACKGRD PPM                           4              0              1
     CO2  SAMPLE  METER READING/SCALE      70.1/2         46.9/2         62.2/2
     CO2  SAMPLE  PERCENT                    2.09           1.30           1.82
     CO2  BACKGRD METER READING/SCALE       1.1/2          1.5/2          2.6/2
     CO2  BACKGRD PERCENT                     .03            .04            .06
     NOX  SAMPLE  METER READING/SCALE      28.7/3         19.9/3         25.6/3
     NOX  SAMPLE  PPM                        86.1           59.7           76.8
     NOX  BACKGRD METER READING/SCALE        .5/3           .6/3           .6/3
     NOX  BACKGRD PPM                         1.5            1.8            1.8

     HC   CONCENTRATION PPM                    30             15             25
     CO   CONCENTRATION PPM                   108             80             95
     CO2  CONCENTRATION PCT                  2.07           1.26           1.76
     NOX  CONCENTRATION PPM                  84.8           58.1           75.2
     HC   MASS GRAMS                          .75            .62            .59
     CO   MASS GRAMS                         5.42           6.52           4.61
     CO2  MASS GRAMS                      1640.56        1639.95        1351.90
     NOX  MASS GRAMS                         5.79           6.48           4.97

     WEIGHTED MASS HC        .11 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .95 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    257.77 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .98 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.4  KILOMETRE/LITRE
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                              TABLE A-6.              VEHICLE EMISSION RESULTS
                                                1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  084        TEST NO. 2          DATE  2/20/74                    MFGR. CODE  380                 YR.  1973
VEHICLE MODEL  NISSAN DIESEL             ENGINE   2.17 LITRE 4            CURB WT.  1415 KG
                                                                          Test Weight  1588 kg

BAROMETER 731.27 MM OF HG.                                             WET BULB TEMP  18.3 DEG. C
DRY BULB TEMP.   27.2 DEG. C                                            ABS. HUMIDITY   9.9 MILLIGRAMS/KG
REL. HUMIDITY     42 PCT.

EVAPORATIVE EMISSIONS

    CANISTER                                        1             2
    FINAL WT.,    GRAMS                         -0.00         -0.00
    INITIAL WT., GRAMS                          -0.00         -0.00
    DIFFERENCE    GRAMS                          0.00          0.00

    TOTAL EVAPORATIVE EMISSIONS                                               0.00 GRAMS

EXHAUST EMISSIONS


    BLOWER DIF. PRESS., G2, 188.0 MM. H2O                            BLOWER INLET PRESS., G1 167.6 MM. H2O
                                                                     BLOWER INLET TEMP.    40 DEG. C
    BAG RESULTS
    BAG NO.                                          1              2              3
    BLOWER REVOLUTIONS                            6880           9068           5876
    HC    SAMPLE  METER READING/SCALE            4.2/3          3.3/3          3.9/3
    HC    SAMPLE  PPM                               42             33             39
    HC    BACKGRD METER READING/SCALE            1.8/3          1.9/3          1.7/3
    HC    BACKGRD PPM                               18             19             17
    CO    SAMPLE  METER READING/SCALE            6.8/3          5.2/3          6.6/3
    CO    SAMPLE  PPM                              102             78             99
    CO    BACKGRD METER READING/SCALE             .7/3           .3/3          0.0/3
    CO    BACKGRD PPM                               10              4              0
    CO2   SAMPLE  METER READING/SCALE           69.4/2         46.3/2         62.5/2
    CO2   SAMPLE  PERCENT                         2.07           1.29           1.83
    CO2   BACKGRD METER READING/SCALE            2.1/2          2.3/2          2.1/2
    CO2   BACKGRD PERCENT                          .05            .06            .05
    NOX   SAMPLE  METER READING/SCALE           25.2/3         17.5/3         23.1/3
    NOX   SAMPLE  PPM                             75.6           52.5           69.3
    NOX   BACKGRD METER READING/SCALE            1.3/3          1.0/3          1.0/3
    NOX   BACKGRD PPM                              3.9            3.0            3.0

    HC    CONCENTRATION PPM                         27             16             24
    CO    CONCENTRATION PPM                         88             71             94
    CO2   CONCENTRATION PCT                       2.02           1.24           1.78
    NOX   CONCENTRATION PPM                       72.3           49.8           66.7
    HC    MASS GRAMS                               .64            .64            .58
    CO    MASS GRAMS                              4.26           5.77           4.55
    CO2   MASS GRAMS                           1544.10        1601.83        1362.12
    NOX   MASS GRAMS                              5.60           6.50           5.16

    WEIGHTED MASS HC        .10 GRAMS/KILOMETRE
    WEIGHTED MASS CO        .85 GRAMS/KILOMETRE
    WEIGHTED MASS CO2    252.28 GRAMS/KILOMETRE
    WEIGHTED MASS NOX       .98 GRAMS/KILOMETRE

    FUEL ECONOMY BY CARBON BALANCE =  10.6  KILOMETRE/LITRE
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TABLE A-7.

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                                   VEHICLE EMISSION RESULTS
                               1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  004         TEST NO. 3          DATE  2/21/79                    MFGR. CODE  380                YR.  1973
VEHICLE MODEL  NISSAN DIESEL              ENGINE    2.17 LITRE 4           CURB WT.  1415 KG
                                                                           Test Weight  1588 kg

BAROMETER 740,16 MM OF HG.                                          WET BULB TEMP  12,8 DEG. C
DRY BULB TEMP.    22,2 DEG. C                                        ABS. HUMIDITY   5,4 MILLIGRAMS/KG
REL. HUMIDITY      32 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1               2
     FINAL WT.,    GRAMS                    -0,00           -0,00
     INITIAL WT., GRAMS                     -0,00           -0,00
     DIFFERENCE    GRAMS                     0,00            0,00

     TOTAL EVAPORATIVE EMISSIONS                                             0,00 GRAMS


EXHAUST EMISSIONS

                                                                    BLOWER INLET PRESS., G1 170,2 MM. H2O
     BLOWER DIF. PRESS., G2, 193,0 MM. H2O                          BLOWER INLET TEMP.    40 DEG. C

     BAG RESULTS
     BAG NO.                                   1                2                3
     BLOWER REVOLUTIONS                     8897             9197             8861
     HC    SAMPLE  METER READING/SCALE       3,9/3            2,6/3            3,0/3
     HC    SAMPLE  PPM                       39               26               30
     HC    BACKGRD METER READING/SCALE       1,6/3            1,3/3            1,1/3
     HC    BACKGRD PPM                       16               13               11
     CO    SAMPLE  METER READING/SCALE       5,5/3            3,6/3            5,2/3
     CO    SAMPLE  PPM                       82               59               78
     CO    BACKGRD METER READING/SCALE       0,0/3            ,5/3             ,7/3
     CO    BACKGRD PPM                       0                7                10
     CO2   SAMPLE  METER READING/SCALE       63,6/2           43,0/2           59,8/2
     CO2   SAMPLE  PERCENT                   1,86             1,19             1,73
     CO2   BACKGRD METER READING/SCALE       2,6/2            2,2/2            1,9/2
     CO2   BACKGRD PERCENT                   ,06              ,05              ,05
     NOX   SAMPLE  METER READING/SCALE       24,7/3           16,9/3           23,2/3
     NOX   SAMPLE  PPM                       74,1             50,7             69,6
     NOX   BACKGRD METER READING/SCALE       ,3/3             ,1/3             ,1/3
     NOX   BACKGRD PPM                       ,9               ,3               ,3

     HC    CONCENTRATION PPM                 25               14               20
     CO    CONCENTRATION PPM                 78               45               65
     CO2   CONCENTRATION PCT                 1,81             1,14             1,69
     NOX   CONCENTRATION PPM                 73,3             50,4             69,3
     HC    MASS GRAMS                        ,61              ,58              ,49
     CO    MASS GRAMS                        3,85             3,75             3,19
     CO2   MASS GRAMS                     1902,02          1998,93          1303,75
     NOX   MASS GRAMS                        5,03             5,87             4,73

     WEIGHTED MASS HC        ,09 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,60 GRAMS/KILOMETRE
     WEIGHTED MASS CO2   235,75 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       ,89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11,3  KILOMETRE/LITRE
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                          TABLE  A-8.              VEHICLE EMISSION RESULTS
                                             1975  LIGHT DUTY EMISSIONS TEST
UNIT NO.  004        TEST NO. 4            DATE  2/22/74
VEHICLE MODEL  NISSAN DIESEL               ENGINE   2.17 LITRE 4                MFGR. CODE  380                YR.  1973
                                                                                CURB WT.  1415 KG
                                                                                Test Weight  1588 kg
BAROMETER 744.81 MM OF HG.
DRY BULB TEMP.    24.4 DEG. C                                                 WET BULB TEMP  11.7 DEG. C
REL. HUMIDITY      17 PCT.                                                     ABS. HUMIDITY   3.2 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER
     FINAL WT.,    GRAMS                          1                2
     INITIAL WT., GRAMS                       -0.00            -0.00
     DIFFERENCE    GRAMS                      -0.00            -0.00
                                               0.00             0.00
     TOTAL EVAPORATIVE EMISSIONS
                                                                             0.00 GRAMS

EXHAUST EMISSIONS


     BLOWER DIF. PRESS., G2, 193.0 MM. H2O                                  BLOWER INLET PRESS., G1 172.7 MM. H2O
                                                                            BLOWER INLET TEMP.    40 DEG. C
     BAG RESULTS
     BAG NO.
     BLOWER REVOLUTIONS                           1                2                3
     HC    SAMPLE  METER READING/SCALE         5673             9171             5346
     HC    SAMPLE  PPM                          8.0/3            3.1/3            3.4/3
     HC    BACKGRD METER READING/SCALE          80               31               34
     HC    BACKGRD PPM                         2.5/3            2.0/3            1.4/3
     CO    SAMPLE  METER READING/SCALE          25               20               14
     CO    SAMPLE  PPM                         4.3/3            4.8/3            6.1/3
     CO    BACKGRD METER READING/SCALE         140               72               41
     CO    BACKGRD PPM                         0.0/3            0.0/3            0.0/3
     CO2   SAMPLE  METER READING/SCALE           0                0                0
     CO2   SAMPLE  PERCENT                    65.4/2           46.5/2           62.2/2
     CO2   BACKGRD METER READING/SCALE        1.94             1.30             1.82
     CO2   BACKGRD PERCENT                     2.4/2            2.3/2            1.4/2
     NOX   SAMPLE  METER READING/SCALE         .06              .06              .05
     NOX   SAMPLE  PPM                        27.0/3           18.8/3           25.2/3
     NOX   BACKGRD METER READING/SCALE        81.0             56.4             75.6
     NOX   BACKGRD PPM                          .2/3             .4/3            0.0/3
                                                .6              1.2              0.0
     HC    CONCENTRATION PPM
     CO    CONCENTRATION PPM                    54               13               22
     CO2   CONCENTRATION PCT                   134               64               88
     NOX   CONCENTRATION PPM                  1.84             1.25             1.77
     HC    MASS GRAMS                         80.5             55.3             75.6
     CO    MASS GRAMS                         1.52              .54              .53
     CO2   MASS GRAMS                         7.02             5.86             4.31
     NOX   MASS GRAMS                      1562.93          1665.64          1380.92
                                              5.55             6.16             4.91
     WEIGHTED MASS HC        .12 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .94 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    258.95 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .94 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.3  KILOMETRE/LITRE
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                   TABLE  A-9.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                      1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  002        TEST NO. 1         DATE  2/19/79              MFGR. CODE  200             YR.  1972
VEHICLE MODEL  MERCEDES DIESEL          ENGINE   2.11 LITRE 4      CURB WT.  1356 KG
                                                                   Test Weight  1588 kg

BAROMETER 735.33 MM OF HG.                                       WET BULB TEMP  12.2 DEG. C
DRY BULB TEMP.    25.0 DEG. C                                     ABS. HUMIDITY   3.7 MILLIGRAMS/KG
REL. HUMIDITY     18 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                1               2
     FINAL WT.,   GRAMS                    -0.00           -0.00
     INITIAL WT., GRAMS                    -0.00           -0.00
     DIFFERENCE   GRAMS                     0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS

EXHAUST EMISSIONS
                                                               BLOWER INLET PRESS., G1 165.1 MM. H2O
     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                     BLOWER INLET TEMP.    40 DEG. C

     BAG RESULTS
     BAG NO.                                  1               2               3
     BLOWER REVOLUTIONS                     5907            9173            5920
     HC   SAMPLE  METER READING/SCALE       12.0/3           6.9/3           6.9/3
     HC   SAMPLE  PPM                        49              28              28
     HC   BACKGRD METER READING/SCALE        4.8/1           4.8/1           5.0/1
     HC   BACKGRD PPM                         5               5               5
     CO   SAMPLE  METER READING/SCALE        6.6/3           4.1/3           4.8/2
     CO   SAMPLE  PPM                        99              61             138
     CO   BACKGRD METER READING/SCALE        0.0/3           0.0/3            .1/3
     CO   BACKGRD PPM                         0               0               1
     CO2  SAMPLE  METER READING/SCALE       68.3/2          41.1/2          52.2/2
     CO2  SAMPLE  PERCENT                   2.03            1.13            1.48
     CO2  BACKGRD METER READING/SCALE        2.1/2           2.6/2           2.7/2
     CO2  BACKGRD PERCENT                    .05             .06             .07
     NOX  SAMPLE  METER READING/SCALE       22.9/3          14.3/3          19.3/3
     NOX  SAMPLE  PPM                       68.7            42.9            57.9
     NOX  BACKGRD METER READING/SCALE        .1/3            .1/3            .1/3
     NOX  BACKGRD PPM                         .3              .3              .3

     HC   CONCENTRATION PPM                  44              23              23
     CO   CONCENTRATION PPM                  99              59             132
     CO2  CONCENTRATION PCT                 1.98            1.07            1.42
     NOX  CONCENTRATION PPM                 68.4            42.6            57.6
     HC   MASS GRAMS                        1.06             .96             .56
     CO   MASS GRAMS                        4.62            4.93            6.95
     CO2  MASS GRAMS                     1533.87         1406.77         1101.77
     NOX  MASS GRAMS                        4.47            4.73            3.78

     WEIGHTED MASS HC        .14 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .88 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    223.27 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .73 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBUN BALANCE =  11.9  KILOMETRE/LITRE
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TABLE A-10. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                                        1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  002         TEST NO. 2         DATE  2/20/79                  MFGR. CODE  200              YR.  1972
VEHICLE MODEL  MERCEDES DIESEL           ENGINE   2.11 LITRE 4          CURB WT.  1356 KG
                                                                        Test Weight  1588 kg

BAROMETER 739.06 MM OF HG.                                             WET BULB TEMP  17.2 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                           ABS. HUMIDITY   9.8 MILLIGRAMS/KG
REL. HUMIDITY      51 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                        1            2
     FINAL WT.,    GRAMS                         -0.00        -0.00
     INITIAL WT., GRAMS                          -0.00        -0.00
     DIFFERENCE    GRAMS                          0.00         0.00

     TOTAL EVAPORATIVE EMISSIONS                                             0.00 GRAMS

EXHAUST EMISSIONS

                                                                    BLOWER INLET PRESS., G1 170.2 MM. H2O
     BLOWER DIF. PRESS., G2, 198.1 MM. H2O                          BLOWER INLET TEMP.   90 DEG. C

     BAG RESULTS
     BAG NO.                                          1            2            3
     BLOWER REVOLUTIONS                            5369         8757         5370
     HC    SAMPLE  METER READING/SCALE           28.1/2       19.1/2       18.9/2
     HC    SAMPLE  PPM                               56           28           37
     HC    BACKGRD METER READING/SCALE            9.8/1        5.0/1        8.8/1
     HC    BACKGRD PPM                                5            5            9
     CO    SAMPLE  METER READING/SCALE            6.0/3        3.8/3        5.9/3
     CO    SAMPLE  PPM                               90           57           81
     CO    BACKGRD METER READING/SCALE             .2/3         .5/3         .9/3
     CO    BACKGRD PPM                                3            7           13
     CO2   SAMPLE  METER READING/SCALE           69.2/2       91.1/2       59.1/2
     CO2   SAMPLE  PERCENT                         2.06         1.13         1.71
     CO2   BACKGRD METER READING/SCALE            1.2/2        1.7/2        1.6/2
     CO2   BACKGRD PERCENT                          .03          .09          .09
     NOX   SAMPLE  METER READING/SCALE           22.8/3       13.9/3       21.2/3
     NOX   SAMPLE  PPM                             68.9         90.2         63.6
     NOX   BACKGRD METER READING/SCALE             .3/3         .5/3         .1/3
     NOX   BACKGRD PPM                               .9          1.5           .3

     HC    CONCENTRATION PPM                         52           29           29
     CO    CONCENTRATION PPM                         82           98           65
     CO2   CONCENTRATION PCT                       2.09         1.09         1.68
     NOX   CONCENTRATION PPM                       67.6         38.8         63.3
     HC    MASS GRAMS                              1.25          .92          .70
     CO    MASS GRAMS                              3.97         3.76         3.15
     CO2   MASS GRAMS                           1553.56      1361.07      1278.99
     NOX   MASS GRAMS                              5.22         9.89         9.89

     WEIGHTED MASS HC        .15 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .60 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    228.56 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .82 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.7  KILOMETRE/LITRE
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TABLE  A-11.          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  002        TEST NO. 3          DATE  2/21/79                  MFGR. CODE  200              YR.  1972
VEHICLE MODEL  MERCEDES DIESEL           ENGINE   2.11 LITRE 4          CURB WT.  1356 KG
                                                                        Test Weight  1588 kg

BAROMETER 737.11 MM OF HG.                                         WET BULB TEMP  12.2 DEG. C
DRY BULB TEMP.   21.7 DEG. C                                        ABS. HUMIDITY   5.1 MILLIGRAMS/KG
REL. HUMIDITY     31 PCT.

EVAPORATIVE EMISSIONS

    CANISTER                                1             2
    FINAL WT.,   GRAMS                   -0.00         -0.00
    INITIAL WT., GRAMS                   -0.00         -0.00
    DIFFERENCE   GRAMS                    0.00          0.00

    TOTAL EVAPORATIVE EMISSIONS                                   0.00 GRAMS

EXHAUST EMISSIONS

    BLOWER DIF. PRESS., G2, 205.7 MM. H2O                        BLOWER INLET PRESS., G1 185.9 MM. H2O
                                                                 BLOWER INLET TEMP.   37 DEG. C
    BAG RESULTS
    BAG NO.                                  1             2             3
    BLOWER REVOLUTIONS                     5378          9169          5379
    HC   SAMPLE  METER READING/SCALE      20.9/2        12.9/2        21.7/2
    HC   SAMPLE  PPM                        92            56            93
    HC   BACKGRD METER READING/SCALE      1.0/1          .8/1          .5/1
    HC   BACKGRD PPM                         1             1             1
    CO   SAMPLE  METER READING/SCALE       5.9/3         3.9/3         4.8/3
    CO   SAMPLE  PPM                        81            51            72
    CO   BACKGRD METER READING/SCALE      0.0/3          .3/3          .3/3
    CO   BACKGRD PPM                         0             4             4
    CO2  SAMPLE  METER READING/SCALE      63.9/2        41.5/2        57.0/2
    CO2  SAMPLE  PERCENT                  1.87          1.19          1.69
    CO2  BACKGRD METER READING/SCALE       2.0/2         2.7/2         3.3/2
    CO2  BACKGRD PERCENT                   .05           .07           .08
    NOX  SAMPLE  METER READING/SCALE      18.9/3        13.7/3        21.6/3
    NOX  SAMPLE  PPM                      56.7          41.1          64.8
    NOX  BACKGRD METER READING/SCALE       1.7/3          .1/3          .1/3
    NOX  BACKGRD PPM                       5.1            .3            .3

    HC   CONCENTRATION PPM                  91            55            93
    CO   CONCENTRATION PPM                  77            45            65
    CO2  CONCENTRATION PCT                1.83          1.08          1.57
    NOX  CONCENTRATION PPM                52.3          40.8          64.5
    HC   MASS GRAMS                        .99          1.03          1.04
    CO   MASS GRAMS                       3.75          3.73          3.16
    CO2  MASS GRAMS                    1911.55       1921.97       1807.11
    NOX  MASS GRAMS                       3.59          4.71          4.36

    WEIGHTED MASS HC        .17 GRAMS/KILOMETRE
    WEIGHTED MASS CO        .59 GRAMS/KILOMETRE
    WEIGHTED MASS CO2    225.15 GRAMS/KILOMETRE
    WEIGHTED MASS NOX       .72 GRAMS/KILOMETRE

    FUEL ECONOMY BY CARBON BALANCE =  11.9  KILOMETRE/LITRE
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TABLE A-12. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                         1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  002          TEST NO. 9          DATE  2/22/79                          MFGR. CODE  200              YR.  1972
VEHICLE MODEL  MERCEDES DIESEL             ENGINE   2.11 LITRE *                  CURB WT.  1356 KG
                                                                                  Test Weight  1588 kg
BAROMETER 749.81 MM OF HG.
DRY BULB TEMP.    23.3 DEG. C                                                   WET BULB TEMP  11.7 DEG. C
REL. HUMIDITY      21 PCT.                                                       ABS. HUMIDITY   3.7 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                    1             2
     FINAL WT.,   GRAMS                        -0.00         -0.00
     INITIAL WT., GRAMS                        -0.00         -0.00
     DIFFERENCE   GRAMS                         0.00          0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 205.7 MM, H2O                              BLOWER INLET PRESS., G1 182.9 MM, H2O
                                                                        BLOWER INLET TEMP.    37 DEG. C
     BAG RESULTS
     BAG NO.                                     1             2             3
     BLOWER REVOLUTIONS                        5922          9106          5370
     HC   SAMPLE  METER READING/SCALE         23.9/2        12.2/2        13.9/2
     HC   SAMPLE  PPM                            48            24            27
     HC   BACKGRD METER READING/SCALE          3.8/1         3.2/1         3.3/1
     HC   BACKGRD PPM                             4             3             3
     CO   SAMPLE  METER READING/SCALE          5.5/3         3.3/3         4.5/3
     CO   SAMPLE  PPM                            82            49            67
     CO   BACKGRD METER READING/SCALE           .4/3          .4/3          .8/3
     CO   BACKGRD PPM                             6             6            12
     CO2  SAMPLE  METER READING/SCALE         61.9/2        37.0/2        53.2/2
     CO2  SAMPLE  PERCENT                      1.79          1.01          1.51
     CO2  BACKGRD METER READING/SCALE          2.8/2         2.2/2         2.9/2
     CO2  BACKGRD PERCENT                       .07           .05           .06
     NOX  SAMPLE  METER READING/SCALE         21.6/3        19.6/3        20.7/3
     NOX  SAMPLE  PPM                          69.8          43.8          62.1
     NOX  BACKGRD METER READING/SCALE           .5/3          .5/3         0.0/3
     NOX  BACKGRD PPM                           1.5           1.5           0.0

     HC   CONCENTRATION PPM                      44            22            29
     CO   CONCENTRATION PPM                      79            42            59
     CO2  CONCENTRATION PCT                    1.73           .96          1.46
     NOX  CONCENTRATION PPM                    63.5          42.4          62.1
     HC   MASS GRAMS                           1.10           .90           .59
     CO   MASS GRAMS                           3.69          3.56          2.69
     CO2  MASS GRAMS                        1366.90       1271.72       1149.61
     NOX  MASS GRAMS                           9.29          9.76          9.11

     WEIGHTED MASS HC         .19 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .55 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     208.19 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .79 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  12.8  KILOMETRE/LITRE
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                    TABLE  A-13.          VEHICLE EMISSION RESULTS
                                    1975  LIGHT DUTY EMISSIONS TEST

UNIT NO, 002        TEST NO, 1          DATE  2/19/79                  MFGR, CODE  200              YR,  1972
VEHICLE MODEL  MERCEDES DIESEL          ENGINE   2,11 LITRE 4          CURB WT,  1316 KG
                                                                       Test Weight 1588 kg

BAROMETER 735,33 MM OF HG,                                          WET BULB TEMP  12,2 DEG, C
DRY BULB TEMP,    25,0 DEG, C                                        ABS, HUMIDITY   3,7 MILLIGRAMS/KG
REL, HUMIDITY      10 PCT,

EVAPORATIVE EMISSIONS

     CANISTER                                    1                2
     FINAL WT.,   GRAMS                      -0,00            -0,00
     INITIAL WT., GRAMS                      -0,00            -0,00
     DIFFERENCE   GRAMS                       0,00             0,00

     TOTAL EVAPORATIVE EMISSIONS                                           0,00 GRAMS


EXHAUST EMISSIONS
                                                                    BLOWER INLET PRESS., G1 165,1 MM, H2O
     BLOWER DIF, PRESS., G2, 190,5 MM, H2O                          BLOWER INLET TEMP,    40 DEG, C

     BAG RESULTS
     BAG NO,                                     1                2                3
     BLOWER REVOLUTIONS                       5907             9179             5980
     HC   SAMPLE  METER READING/SCALE        2,6/3            2,1/3            2,2/3
     HC   SAMPLE  PPM                          26               21               22
     HC   BACKGRD METEX READING/SCALE         ,8/3             ,7/3             ,8/3
     HC   BACKGRD PPM                           8                7                8
     CO   SAMPLE  METER READING/SCALE        6,6/3            4,1/3            9,8/2
     CO   SAMPLE  PPM                          99               61              138
     CO   BACKGRD METER READING/SCALE        0,0/3            0,0/3             ,1/3
     CO   BACKGRD PPM                           0                0                1
     CO2  SAMPLE  METER READING/SCALE       68,3/2           41,1/2           62,2/2
     CO2  SAMPLE  PERCENT                    2,03             1,13             1,98
     CO2  BACKGRD METER READING/SCALE        2,1/2            2,6/2            2,7/2
     CO2  BACKGRD PERCENT                     ,05              ,06              ,07
     NOX  SAMPLE  METER READING/SCALE       22,9/3           19,3/3           19,3/3
     NOX  SAMPLE  PPM                        68,7             48,9             57,9
     NOX  BACKGRD METER READING/SCALE         ,1/3             ,1/3             ,1/3
     NOX  BACKGRD PPM                          ,3               ,3               ,3

     HC   CONCENTRATION PPM                    19               18               15
     CO   CONCENTRATION PPM                    99               59              132
     CO2  CONCENTRATION PCT                  1,98             1,07             1,92
     NOX  CONCENTRATION PPM                  68,4             42,6             57,6
     HC   MASS GRAMS                          ,97              ,60              ,36
     CO   MASS GRAMS                         4,62             4,93             6,95
     CO2  MASS GRAMS                      1533,86          1406,77          1101,77
     NOX  MASS GRAMS                         4,47             4,73             3,78

     WEIGHTED MASS HC        ,08 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,88 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    223,27 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       ,73 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  12,0  KILOMETRE/LITRE
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              TABLE A-14.        VEHICLE EMISSION RESULTS
                            1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  002        TEST NO. 2        DATE  2/20/79                    MFGR. CODE  200              YR.  1972
VEHICLE MODEL  MERCEDES DIESEL         ENGINE   2.11 LITRE *            CURB WT.  1366 KG
                                                                        Test Weight  1588 kg
BAROMETER 734.06 MM OF HG.
DRY BULB TEMP.    23.9 DEG. C                                       WET BULB TEMP  17.2 DEG. C
REL. HUMIDITY      51 PCT.                                           ABS. HUMIDITY   9.8 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,   GRAMS                       -0.00          -0.00
     INITIAL WT., GRAMS                       -0.00          -0.00
     DIFFERENCE   GRAMS                        0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                             0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 198.1 MM. H2O                      BLOWER INLET PRESS., G1 170.2 MM. H2O
                                                                BLOWER INLET TEMP.    40 DEG. C
     BAG RESULTS
     BAG NO.                                      1              2              3
     BLOWER REVOLUTIONS                         5369           8787           5370
     HC    SAMPLE  METER READING/SCALE           3.9/3          2.9/3          2.9/3
     HC    SAMPLE  PPM                           39             29             29
     HC    BACKGRD METER READING/SCALE           1.9/3          1.9/3          1.5/3
     HC    BACKGRD PPM                           19             19             15
     CO    SAMPLE  METER READING/SCALE           6.0/3          3.8/3          5.9/3
     CO    SAMPLE  PPM                           90             57             81
     CO    BACKGRD METER READING/SCALE           .2/3           .5/3           .9/3
     CO    BACKGRD PPM                           3              7              13
     CO2   SAMPLE  METER READING/SCALE          69.2/2         41.1/2         59.1/2
     CO2   SAMPLE  PERCENT                      2.06           1.13           1.71
     CO2   BACKGRD METER READING/SCALE          1.2/2          1.7/2          1.6/2
     CO2   BACKGRD PERCENT                      .03            .04            .04
     NOX   SAMPLE  METER READING/SCALE         22.8/3         13.9/3         21.2/3
     NOX   SAMPLE  PPM                          68.9           40.2           63.6
     NOX   BACKGRD METER READING/SCALE           .3/3           .5/3           .1/3
     NOX   BACKGRD PPM                           .9            1.5            .3

     HC    CONCENTRATION PPM                     27             11             16
     CO    CONCENTRATION PPM                     82             48             65
     CO2   CONCENTRATION PCT                    2.04           1.09           1.68
     NOX   CONCENTRATION PPM                    67.6           38.8           63.3
     HC    MASS GRAMS                            .65            .49            .38
     CO    MASS GRAMS                           3.97           3.76           3.15
     CO2   MASS GRAMS                        1553.55        1361.07        1278.93
     NOX   MASS GRAMS                           5.22           4.89           4.89

     WEIGHTED MASS HC        .08 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .60 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    228.55 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .82 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.7  KILOMETRE/LITRE
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TABLE A-15. VEHICLE EMISSION RESULTS
1975 LIGHT DUTY EMISSIONS TEST

UNIT NO. 002 TEST NO. 3	DATE 2/21/79	MFGR. CODE 200	YR. 1972
VEHICLE MODEL MECERDES DIESEL	ENGINE 2.11 LITRE 4	CURB WT. 1366 KG	
		Test Weight 1588 kg	

BAROMETER 737.11 MM OF HG.
DRY BULB TEMP. 21.7 DEG. C
REL. HUMIDITY 31 PCT.

WET BULB TEMP 12.2 DEG. C
ABS. HUMIDITY 5.1 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

CANISTER	1	2
FINAL WT., GRAMS	-0.00	-0.00
INITIAL WT., GRAMS	-0.00	-0.00
DIFFERENCE GRAMS	0.00	0.00

TOTAL EVAPORATIVE EMISSIONS 0.00 GRAMS

EXHAUST EMISSIONS

BLOWER DIF. PRESS., G2, 205.7 MM. H2O

BLOWER INLET PRESS., G1 186.4 MM. H2O
BLOWER INLET TEMP. 37 DEG. C

BAG RESULTS			
BAG NO.	1	2	3
BLOWER REVOLUTIONS	5378	9164	5379
HC SAMPLE METER READING/SCALE	3.1/3	2.0/3	2.2/3
HC SAMPLE PPM	31	20	22
HC BACKGRD METER READING/SCALE	1.5/3	.4/3	.8/3
HC BACKGRD PPM	15	4	8
CO SAMPLE METER READING/SCALE	5.4/3	3.4/3	4.8/3
CO SAMPLE PPM	81	51	72
CO BACKGRD METER READING/SCALE	0.0/3	.3/3	.3/3
CO BACKGRD PPM	0	4	4
CO2 SAMPLE METER READING/SCALE	63.4/2	41.5/2	57.0/2
CO2 SAMPLE PERCENT	1.87	1.14	1.64
CO2 BACKGRD METER READING/SCALE	2.0/2	2.7/2	3.3/2
CO2 BACKGRD PERCENT	.05	.07	.08
NOX SAMPLE METER READING/SCALE	18.4/3	13.7/3	21.6/3
NOX SAMPLE PPM	56.7	41.1	64.8
NOX BACKGRD METER READING/SCALE	1.7/3	.1/3	.1/3
NOX BACKGRD PPM	5.1	.3	.3
HC CONCENTRATION PPM	18	12	15
CO CONCENTRATION PPM	77	45	65
CO2 CONCENTRATION PCT	1.83	1.08	1.57
NOX CONCENTRATION PPM	52.3	40.8	64.6
HC MASS GRAMS	.44	.48	.36
CO MASS GRAMS	3.75	3.73	3.16
CO2 MASS GRAMS	1911.55	1921.97	1807.10
NOX MASS GRAMS	3.54	4.71	4.36

WEIGHTED MASS HC .07 GRAMS/KILOMETRE
WEIGHTED MASS CO .59 GRAMS/KILOMETRE
WEIGHTED MASS CO2 225.15 GRAMS/KILOMETRE
WEIGHTED MASS NOX .72 GRAMS/KILOMETRE

FUEL ECONOMY BY CARBON BALANCE = 11.9 KILOMETRE/LITRE

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                              TABLE A-16.            VEHICLE EMISSION RESULTS
                                               1975  LIGHT DUTY EMISSIONS TEST

UNIT NO. 002          TEST NO. 9              DATE  2/22/79                        MFGR. CODE  200                 YR.  1972
VEHICLE MODEL  MERCEDES DIESEL                ENGINE   2.11 LITRE *                CURB WT.  1366 KG
                                                                                   Test Weight  1588 kg
BAROMETER 749.81 MM OF HG.
DRY BULB TEMP.    23.3 DEG. C                                                   WET BULB TEMP  11.7 DEG. C
REL. HUMIDITY      21 PCT.                                                       ABS. HUMIDITY   3.7 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                   1            2
     FINAL WT.,   GRAMS                      -0.00        -0.00
     INITIAL WT., GRAMS                      -0.00        -0.00
     DIFFERENCE   GRAMS                       0.00         0.00

     TOTAL EVAPORATIVE EMISSIONS                                           0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 205.7 MM. H2O                        BLOWER INLET PRESS., G1 182.9 MM. H2O
                                                                  BLOWER INLET TEMP.    37 DEG. C
     BAG RESULTS
     BAG NO.                                      1            2            3
     BLOWER REVOLUTIONS                        5422         9106         5370
     HC   SAMPLE  METER READING/SCALE           2.6/3        1.9/3        2.1/3
     HC   SAMPLE  PPM                          26           19           21
     HC   BACKGRD METER READING/SCALE           1.0/3        1.0/3         .9/3
     HC   BACKGRD PPM                          10           10            9
     CO   SAMPLE  METER READING/SCALE           5.5/3        3.3/3        4.5/3
     CO   SAMPLE  PPM                          82           49           67
     CO   BACKGRD METER READING/SCALE            .4/3         .4/3         .8/3
     CO   BACKGRD PPM                           6            6           12
     CO2  SAMPLE  METER READING/SCALE          61.9/2       37.0/2       53.2/2
     CO2  SAMPLE  PERCENT                       1.79         1.01         1.51
     CO2  BACKGRD METER READING/SCALE           2.8/2        2.2/2        2.4/2
     CO2  BACKGRD PERCENT                        .07          .05          .06
     NOX  SAMPLE  METER READING/SCALE          21.6/3       14.6/3       20.7/3
     NOX  SAMPLE  PPM                          64.8         43.8         62.1
     NOX  BACKGRD METER READING/SCALE            .5/3         .5/3        0.0/3
     NOX  BACKGRD PPM                           1.5          1.5          0.0

     HC   CONCENTRATION PPM                    17           10           13
     CO   CONCENTRATION PPM                    74           42           54
     CO2  CONCENTRATION PCT                     1.73          .96         1.46
     NOX  CONCENTRATION PPM                    63.5         42.4         62.1
     HC   MASS GRAMS                             .43          .41          .32
     CO   MASS GRAMS                            3.69         3.56         2.69
     CO2  MASS GRAMS                         1366.39      1271.71      1199.61
     NOX  MASS GRAMS                            4.24         4.76         4.11

     WEIGHTED MASS HC        .06 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .55 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    208.14 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .74 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  12.9  KILOMETRE/LITRE
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TABLE A-17. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                              1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  003         TEST NO. 1          DATE  2/19/74                MFGR. CODE  410           YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL             ENGINE   2.20 LITRE 4        CURB WT.  1280 KG
                                                                       Test Weight  1361 kg

BAROMETER 737.11 MM OF HG.                                          WET BULB TEMP  12.8 DEG. C
DRY BULB TEMP.   25.6 DEG. C                                         ABS. HUMIDITY   4.0 MILLIGRAMS/KG
REL. HUMIDITY     19 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                    1              2
     FINAL WT.,    GRAMS                     -0.00          -0.00
     INITIAL WT.,  GRAMS                     -0.00          -0.00
     DIFFERENCE    GRAMS                      0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS


EXHAUST EMISSIONS

                                                                    BLOWER INLET PRESS., G1 165.1 MM. H2O
     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                          BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                     1              2              3
     BLOWER REVOLUTIONS                       4860           8958           5372
     HC   SAMPLE  METER READING/SCALE         51.3/3         58.0/3         35.6/4
     HC   SAMPLE  PPM                         205            232            206
     HC   BACKGRD METER READING/SCALE          2.4/1          3.0/1          2.0/1
     HC   BACKGRD PPM                           2              3              2
     CO   SAMPLE  METER READING/SCALE         11.8/3          9.6/3         11.5/3
     CO   SAMPLE  PPM                         179            195            179
     CO   BACKGRD METER READING/SCALE          .2/3           .3/3          0.0/3
     CO   BACKGRD PPM                           3              4              0
     CO2  SAMPLE  METER READING/SCALE         67.3/2         43.6/2         59.0/2
     CO2  SAMPLE  PERCENT                     1.99           1.21           1.71
     CO2  BACKGRD METER READING/SCALE          1.2/2          1.7/2          1.7/2
     CO2  BACKGRD PERCENT                      .03            .04            .04
     NOX  SAMPLE  METER READING/SCALE         20.2/3         12.8/3         17.2/3
     NOX  SAMPLE  PPM                         60.6           38.4           51.6
     NOX  BACKGRD METER READING/SCALE          .3/3           .2/3           .1/3
     NOX  BACKGRD PPM                           .9             .6             .3

     HC   CONCENTRATION PPM                   203            229            203
     CO   CONCENTRATION PPM                   169            137            167
     CO2  CONCENTRATION PCT                   1.97           1.17           1.67
     NOX  CONCENTRATION PPM                   59.8           37.9           51.3
     HC   MASS GRAMS                          4.99           9.63           6.09
     CO   MASS GRAMS                          7.93          11.09           8.16
     CO2  MASS GRAMS                       1370.67        1497.89        1285.67
     NOX  MASS GRAMS                          3.55           4.19           3.37

     WEIGHTED MASS HC       1.25 GRAMS/KILOMETRE
     WEIGHTED MASS CO       1.57 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    233.69 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      .63 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.2  KILOMETRE/LITRE
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TABLE A-19. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
1975 LIGHT DUTY EMISSIONS TEST

UNIT NO. 003 TEST NO. 2
VEHICLE MODEL PEUGEOT DIESEL
DATE 2/20/74
ENGINE 2.20 LITRE 4
MFGR. CODE 410
CURB WT. 1280 KG
Test Weight: 1361 kg
YR. 1973

BAROMETER 732.03 MM OF HG.
DRY BULB TEMP. 26.1 DEG. C
REL. HUMIDITY 41 PCT.
WET BULB TEMP 17.2 DEG. C
ABS. HUMIDITY 8.4 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

CANISTER	1	2
FINAL WT., GRAMS	-0.00	-0.00
INITIAL WT., GRAMS	-0.00	-0.00
DIFFERENCE GRAMS	0.00	0.00

TOTAL EVAPORATIVE EMISSIONS 0.00 GRAMS

EXHAUST EMISSIONS

BLOWER DIF. PRESS., G2, 180.3 MM. H2O
BLOWER INLET PRESS., G1 157.5 MM. H2O
BLOWER INLET TEMP. 40 DEG. C

BAG RESULTS

BAG NO.	1	2	3
BLOWER REVOLUTIONS	5276	8890	5380
HC SAMPLE METER READING/SCALE	25.1/4	31.0/4	36.9/4
HC SAMPLE PPM	201	248	292
HC BACKGRD METER READING/SCALE	4.8/1	4.8/1	4.7/1
HC BACKGRD PPM	5	5	5
CO SAMPLE METER READING/SCALE	12.3/3	8.8/3	11.3/3
CO SAMPLE PPM	187	132	171
CO BACKGRD METER READING/SCALE	.7/3	.5/3	.1/3
CO BACKGRD PPM	10	7	1
CO2 SAMPLE METER READING/SCALE	67.6/2	44.5/2	59.0/2
CO2 SAMPLE PERCENT	2.00	1.24	1.71
CO2 BACKGRD METER READING/SCALE	2.5/2	2.4/2	2.1/2
CO2 BACKGRD PERCENT	.06	.06	.05
NOX SAMPLE METER READING/SCALE	17.6/3	11.1/3	15.4/3
NOX SAMPLE PPM	52.8	33.3	46.2
NOX BACKGRD METER READING/SCALE	.8/3	.5/3	.1/3
NOX BACKGRD PPM	2.4	1.5	.3
HC CONCENTRATION PPM	196	243	287
CO CONCENTRATION PPM	169	121	162
CO2 CONCENTRATION PCT	1.95	1.18	1.66
NOX CONCENTRATION PPM	50.8	31.9	45.9
HC MASS GRAMS	4.74	9.71	6.94
CO MASS GRAMS	8.21	9.74	7.90
CO2 MASS GRAMS	1500.53	1504.37	1278.65
NOX MASS GRAMS	3.83	3.99	3.47

WEIGHTED MASS HC 1.30 GRAMS/KILOMETRE
WEIGHTED MASS CO 1.47 GRAMS/KILOMETRE
WEIGHTED MASS CO2 238.53 GRAMS/KILOMETRE
WEIGHTED MASS NOX .63 GRAMS/KILOMETRE

FUEL ECONOMY BY CARBON BALANCE = 11.0 KILOMETRE/LITRE

TABLE A-19. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
1975 LIGHT DUTY EMISSIONS TEST

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UNIT NO. 003        TEST NO. 3          DATE 2/21/74                     MFGR. CODE 410              YR. 1973
VEHICLE MODEL  PEUGEOT DIESEL           ENGINE   2.20 LITRE *            CURB WT.  1280 KG
                                                                         Test Weight 1361 kg

BAROMETER 737.11 MM OF HG.                                             WET BULB TEMP  12.2 DEG. C
DRY BULB TEMP.   22.2 DEG. C                                            ABS. HUMIDITY   4.9 MILLIGRAMS/KG
REL. HUMIDITY     29 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,   GRAMS                       -0.00          -0.00
     INITIAL WT., GRAMS                       -0.00          -0.00
     DIFFERENCE   GRAMS                        0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                           0.00 GRAMS

EXHAUST EMISSIONS

                                                                   BLOWER INLET PRESS., G1 175.3 MM. H2O
     BLOWER DIF. PRESS., G2, 200.7 MM. H2O                          BLOWER INLET TEMP.    37 DEG. C

     BAG RESULTS
     BAG NO.                                     1              2              3
     BLOWER REVOLUTIONS                        8374           9172           8374
     HC    SAMPLE  METER READING/SCALE        21.5/4         22.7/4         36.4/4
     HC    SAMPLE  PPM                         172            181            291
     HC    BACKGRD METER READING/SCALE         0.0/1          2.0/1          0.0/1
     HC    BACKGRD PPM                           0              2              0
     CO    SAMPLE  METER READING/SCALE        10.6/3          7.6/3         10.7/3
     CO    SAMPLE  PPM                         160            114            162
     CO    BACKGRD METER READING/SCALE          .7/3          1.2/3           .1/3
     CO    BACKGRD PPM                          10             18              1
     CO2   SAMPLE  METER READING/SCALE        64.1/2         43.3/2         58.4/2
     CO2   SAMPLE  PERCENT                    1.88           1.20           1.70
     CO2   BACKGRD METER READING/SCALE         2.9/2          2.4/2          2.6/2
     CO2   BACKGRD PERCENT                     .07            .06            .06
     NOX   SAMPLE  METER READING/SCALE        18.1/3         12.0/3         15.6/3
     NOX   SAMPLE  PPM                        54.3           36.0           46.8
     NOX   BACKGRD METER READING/SCALE         1.1/3           .1/3           .2/3
     NOX   BACKGRD PPM                         3.3             .3             .6

     HC    CONCENTRATION PPM                   172            180            291
     CO    CONCENTRATION PPM                   144             94            154
     CO2   CONCENTRATION PCT                  1.82           1.15           1.65
     NOX   CONCENTRATION PPM                  51.5           35.7           46.3
     HC    MASS GRAMS                         4.17           7.43           7.05
     CO    MASS GRAMS                         7.06           7.89           7.52
     CO2   MASS GRAMS                      1405.65        1510.55        1272.63
     NOX   MASS GRAMS                         3.47           4.11           3.12

     WEIGHTED MASS HC       1.10 GRAMS/KILOMETRE
     WEIGHTED MASS CO       1.26 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    235.37 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .61 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.2  KILOMETRE/LITRE
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TABLE  A-20.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  003        TEST NO. 4          DATE  2/22/79                  MFGR. CODE  910              YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL            ENGINE    2.20 LITRE 4         CURB WT.  1280 KG
                                                                        Test Weight  1361 kg

BAROMETER 749.30 MM OF HG.                                            WET BULB TEMP  11.7 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                          ABS. HUMIDITY   3.5 MILLIGRAMS/KG
REL. HUMIDITY      19 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,   GRAMS                     -0.00          -0.00
     INITIAL WT., GRAMS                     -0.00          -0.00
     DIFFERENCE   GRAMS                      0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                        0.00 GRAMS

EXHAUST EMISSIONS

                                                                 BLOWER INLET PRESS., G1 170.2 MM. H2O
     BLOWER DIF. PRESS., G2, 193.0 MM. H2O                       BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                    1              2              3
     BLOWER REVULUTIONS                      5364           9176           5362
     HC   SAMPLE  METER READING/SCALE      40.3/4         44.4/4         39.2/4
     HC   SAMPLE  PPM                         322            355            313
     HC   BACKGRD METER READING/SCALE      68.8/2         83.2/2         31.5/1
     HC   BACKGRD PPM                         138            166             31
     CO   SAMPLE  METER READING/SCALE      11.8/3          9.5/3         10.6/3
     CO   SAMPLE  PPM                         179            143            160
     CO   BACKGRD METER READING/SCALE        .7/3           .3/3          1.1/3
     CO   BACKGRD PPM                          10              4             16
     CO2  SAMPLE  METER READING/SCALE      63.5/2         38.2/2         54.7/2
     CO2  SAMPLE  PERCENT                    1.86           1.04           1.56
     CO2  BACKGRD METER READING/SCALE       1.7/2          1.5/2          1.1/2
     CO2  BACKGRD PERCENT                     .04            .04            .03
     NOX  SAMPLE  METER READING/SCALE      19.3/3         11.7/3         15.8/3
     NOX  SAMPLE  PPM                        57.9           35.1           47.4
     NOX  BACKGRD METER READING/SCALE        .5/3           .3/3          1.1/3
     NOX  BACKGRD PPM                         1.5             .9            3.3

     HC   CONCENTRATION PPM                   204            202            286
     CO   CONCENTRATION PPM                   163            135            140
     CO2  CONCENTRATION PCT                  1.82           1.01           1.54
     NOX  CONCENTRATION PPM                  56.6           34.3           44.5
     HC   MASS GRAMS                         5.00           8.47           6.99
     CO   MASS GRAMS                         8.09          11.45           6.93
     CO2  MASS GRAMS                      1423.50        1348.13        1200.91
     NOX  MASS GRAMS                         3.71           3.84           2.92

     WEIGHTED MASS HC        1.21 GRAMS/KILOMETRE
     WEIGHTED MASS CO        1.56 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     219.16 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .59 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.9  KILOMETRE/LITRE
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                    TABLE  A-21.            VEHICLE EMISSION RESULTS
                                      1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  003        TEST NO. 1          DATE  2/19/74                    MFGR. CODE  410                YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL            ENGINE   2.20  LITRE 4           CURB WT.  1280 KG
                                                                          Test Weight  1361 kg

BAROMETER 737.11 MM OF HG.                                              WET BULB TEMP  12.8 DEG. C
DRY BULB TEMP.   25.6 DEG. C                                             ABS. HUMIDITY   4.0 MILLIGRAMS/KG
REL. HUMIDITY     19 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                      1               2
     FINAL WT.,   GRAMS                        -0.00           -0.00
     INITIAL WT., GRAMS                        -0.00           -0.00
     DIFFERENCE   GRAMS                         0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                             0.00 GRAMS


EXHAUST EMISSIONS

                                                                        BLOWER INLET PRESS., G1 165.1 MM. H2O
     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                              BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                       1               2               3
     BLOWER REVOLUTIONS                         9860            8952            6878
     HC   SAMPLE  METER READING/SCALE          6.6/3           7.3/3          11.9/3
     HC   SAMPLE  PPM                             66              73             119
     HC   BACKGRD METER READING/SCALE           .6/3            .9/3           1.3/3
     HC   BACKGRD PPM                              6               9              13
     CO   SAMPLE  METER READING/SCALE         11.8/3           9.6/3          11.5/3
     CO   SAMPLE  PPM                            179             145             179
     CO   BACKGRD METER READING/SCALE           .2/3            .3/3           0.0/3
     CO   BACKGRD PPM                              3               4               0
     CO2  SAMPLE  METER READING/SCALE         67.3/2          43.5/2          59.0/2
     CO2  SAMPLE  PERCENT                       1.99            1.21            1.71
     CO2  BACKGRD METER READING/SCALE          1.2/2           1.7/2           1.7/2
     CO2  BACKGRD PERCENT                        .03             .04             .04
     NOX  SAMPLE  METER READING/SCALE         20.2/3          12.8/3          17.2/3
     NOX  SAMPLE  PPM                           60.6            38.4            51.6
     NOX  BACKGRD METER READING/SCALE           .3/3            .2/3            .1/3
     NOX  BACKGRD PPM                             .9              .6              .3

     HC   CONCENTRATION PPM                       61              65             103
     CO   CONCENTRATION PPM                      169             137             167
     CO2  CONCENTRATION PCT                     1.97            1.17            1.67
     NOX  CONCENTRATION PPM                     59.8            37.9            51.3
     HC   MASS GRAMS                            1.33            2.61            2.48
     CO   MASS GRAMS                            7.43           11.09            8.16
     CO2  MASS GRAMS                         1370.65         1497.83         1885.62
     NOX  MASS GRAMS                            3.55            4.14            3.37

     WEIGHTED MASS HC        .38 GRAMS/KILOMETRE
     WEIGHTED MASS CO       1.57 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    233.69 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .63 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.3  KILOMETRE/LITRE
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                    TABLE  A-22.            VEHICLE EMISSION RESULTS
                                      1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  003          TEST NO. 2          DATE  2/20/79                       MFGR. CODE  410                    YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL              ENGINE   2.20  LITRE 4              CURB WT.  1200 KG
                                                                               Test Weight  1361 kt
BAROMETER 732.03 MM OF HG.
DRY BULB TEMP.   26.1 DEG. C                                                WET BULB TEMP  17.2 DEG. C
REL. HUMIDITY     41 PCT.                                                    ABS. HUMIDITY   8.9 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                        1              2
     FINAL WT.,    GRAMS                          -0.00          -0.00
     INITIAL WT.,  GRAMS                          -0.00          -0.00
     DIFFERENCE    GRAMS                           0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                                     0.00 GRAMS

EXHAUST EMISSIONS


     BLOWER DIF. PRESS., G2, 180.3 MM. H2O                             BLOWER INLET PRESS., G1 157.5 MM. H2O
                                                                       BLOWER INLET TEMP.    40 DEG. C
     BAG RESULTS
     BAG NO.                                         1              2              3
     BLOWER REVOLUTIONS                            5376           8890           5380
     HC    SAMPLE  METER READING/SCALE            8.7/3          7.5/3         11.9/3
     HC    SAMPLE  PPM                             87             75            119
     HC    BACKGRD METER READING/SCALE            1.6/3          1.7/3          2.2/3
     HC    BACKGRD PPM                             16             17             22
     CO    SAMPLE  METER READING/SCALE           12.3/3          8.8/3         11.3/3
     CO    SAMPLE  PPM                            187            132            171
     CO    BACKGRD METER READING/SCALE             .7/3           .5/3           .1/3
     CO    BACKGRD PPM                             10              7              1
     CO2   SAMPLE  METER READING/SCALE           67.6/2         44.5/2         59.0/2
     CO2   SAMPLE  PERCENT                        2.00           1.24           1.71
     CO2   BACKGRD METER READING/SCALE            2.5/2          2.4/2          2.1/2
     CO2   BACKGRD PERCENT                         .06            .06            .05
     NOX   SAMPLE  METER READING/SCALE           17.6/3         11.1/3         15.4/3
     NOX   SAMPLE  PPM                            52.8           33.3           46.2
     NOX   BACKGRD METER READING/SCALE             .8/3           .5/3           .1/3
     NOX   BACKGRD PPM                             2.4            1.5             .3

     HC    CONCENTRATION PPM                       73             60            100
     CO    CONCENTRATION PPM                      168            121            162
     CO2   CONCENTRATION PCT                      1.95           1.18           1.66
     NOX   CONCENTRATION PPM                      50.8           31.9           45.9
     HC    MASS GRAMS                             1.77           2.38           2.41
     CO    MASS GRAMS                             8.21           9.74           7.90
     CO2   MASS GRAMS                          1500.99        1509.27        1278.60
     NOX   MASS GRAMS                             3.83           3.99           3.47

     WEIGHTED MASS HC        .37 GRAMS/KILOMETRE
     WEIGHTED MASS CO       1.47 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    238.52 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .63 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.1  KILOMETRE/LITRE
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                      TABLE  A-23.         VEHICLE EMISSION RESULTS
                                      1975  LIGHT DUTY EMISSIONS TEST

UNIT NO. 003         TEST NO. 3        DATE  2/21/79                       MFGR. CODE  410               YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL          ENGINE   2.20 LITRE 4               CURB WT.  1280 KG
                                                                           Test Weight 1361 kg

BAROMETER 737,11 MM OF HG.                                          WET BULB TEMP  12,2 DEG. C
DRY BULB TEMP.    22,2 DEG. C                                        ABS. HUMIDITY   4,9 MILLIGRAMS/KG
REL. HUMIDITY      29 PCT.

EVAPORATIVE EMISSIONS

   CANISTER                                    1             2
   FINAL WT.,    GRAMS                       -0,00         -0,00
   INITIAL WT., GRAMS                        -0,00         -0,00
   DIFFERENCE    GRAMS                        0,00          0,00

   TOTAL EVAPORATIVE EMISSIONS                                        0,00 GRAMS


EXHAUST EMISSIONS

                                                                    BLOWER INLET PRESS., G1 175,3 MM. H2O
   BLOWER DIF. PRESS., G2, 200,7 MM. H2O                            BLOWER INLET TEMP.    37 DEG. C

   BAG RESULTS
   BAG NO.                                     1             2             3
   BLOWER REVOLUTIONS                        5374          9172          5374
   HC   SAMPLE  METER READING/SCALE           7,5/3         6,6/3        10,2/3
   HC   SAMPLE  PPM                           75            66           102
   HC   BACKGRD METER READING/SCALE           1,3/3         1,6/3         1,5/3
   HC   BACKGRD PPM                           13            16            15
   CO   SAMPLE  METER READING/SCALE          10,6/3         7,6/3        10,7/3
   CO   SAMPLE  PPM                          160           119           162
   CO   BACKGRD METER READING/SCALE            ,7/3         1,2/3          ,1/3
   CO   BACKGRD PPM                           10            18             1
   CO2  SAMPLE  METER READING/SCALE          69,1/2        43,3/2        58,9/2
   CO2  SAMPLE  PERCENT                      1,88          1,20          1,70
   CO2  BACKGRD METER READING/SCALE           2,9/2         2,4/2         2,6/2
   CO2  BACKGRD PERCENT                       ,07           ,06           ,06
   NOX  SAMPLE  METER READING/SCALE          18,1/3        12,0/3        15,6/3
   NOX  SAMPLE  PPM                          54,3          36,0          46,8
   NOX  BACKGRD METER READING/SCALE           1,1/3          ,1/3          ,2/3
   NOX  BACKGRD PPM                           3,3            ,3            ,6

   HC   CONCENTRATION PPM                     64            51            89
   CO   CONCENTRATION PPM                    144            94           154
   CO2  CONCENTRATION PCT                    1,82          1,15          1,66
   NOX  CONCENTRATION PPM                    51,5          35,7          46,3
   HC   MASS GRAMS                           1,55          2,13          2,16
   CO   MASS GRAMS                           7,06          7,89          7,52
   CO2  MASS GRAMS                         1405,61       1510,98       1272,56
   NOX  MASS GRAMS                           3,47          4,11          3,12

   WEIGHTED MASS HC        ,33 GRAMS/KILOMETRE
   WEIGHTED MASS CO       1,26 GRAMS/KILOMETRE
   WEIGHTED MASS CO2    235,36 GRAMS/KILOMETRE
   WEIGHTED MASS NOX       ,61 GRAMS/KILOMETRE

   FUEL ECONOMY BY CARBON BALANCE =  11,3  KILOMETRE/LITRE
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                    TABLE  A-24.          VEHICLE EMISSION RESULTS
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  003         TEST NO. 9        DATE  2/22/79                MFGR. CODE  910              YR.  1973
VEHICLE MODEL  PEUGEOT DIESEL           ENGINE   2.20 LITRE 9        CURB WT.  1280 KG
                                                                     Test Weight 1361 kg

BAROMETER 799.30 MM OF HG.                                         WET BULB TEMP  11.7 DEG. C
DRY BULB TEMP.   23.9 DEG. C                                        ABS. HUMIDITY   3.5 MILLIGRAMS/KG
REL. HUMIDITY     19 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                              1            2
     FINAL WT.,   GRAMS                -0.00        -0.00
     INITIAL WT., GRAMS                -0.00        -0.00
     DIFFERENCE   GRAMS                 0.00         0.00

     TOTAL EVAPORATIVE EMISSIONS                                  0.00 GRAMS

EXHAUST EMISSIONS

                                                                  BLOWER INLET PRESS., G1 170.2 MM. H2O
     BLOWER DIF. PRESS., G2, 193.0 MM. H2O                        BLOWER INLET TEMP.   90 DEG. C

     BAG RESULTS
     BAG NO.                                   1             2             3
     BLOWER REVOLUTIONS                     5369          9176          5362
     HC   SAMPLE  METER READING/SCALE      7.6/3         7.1/3        11.2/3
     HC   SAMPLE  PPM                         76            71           112
     HC   BACKGRD METER READING/SCALE      1.2/3         1.9/3         1.7/3
     HC   BACKGRD PPM                         12            19            17
     CO   SAMPLE  METER READING/SCALE     11.8/3         9.5/3        10.6/3
     CO   SAMPLE  PPM                        179           193           160
     CO   BACKGRD METER READING/SCALE       .7/3          .3/3         1.1/3
     CO   BACKGRD PPM                         10             9            16
     CO2  SAMPLE  METER READING/SCALE     63.5/2        38.2/2        59.7/2
     CO2  SAMPLE  PERCENT                   1.86          1.09          1.66
     CO2  BACKGRD METER READING/SCALE      1.7/2         1.5/2         1.1/2
     CO2  BACKGRD PERCENT                    .09           .09           .03
     NOX  SAMPLE  METER READING/SCALE     19.3/3        11.7/3        15.8/3
     NOX  SAMPLE  PPM                       57.9          35.1          47.9
     NOX  BACKGRD METER READING/SCALE       .5/3          .3/3         1.1/3
     NOX  BACKGRD PPM                        1.5            .9           3.3

     HC   CONCENTRATION PPM                   66            58            97
     CO   CONCENTRATION PPM                  163           135           190
     CO2  CONCENTRATION PCT                 1.82          1.01          1.59
     NOX  CONCENTRATION PPM                 56.6          39.3          99.5
     HC   MASS GRAMS                        1.61          2.93          2.37
     CO   MASS GRAMS                        8.09         11.95          6.93
     CO2  MASS GRAMS                     1923.93       1398.02       1200.88
     NOX  MASS GRAMS                        3.71          3.89          2.92

     WEIGHTED MASS HC         .37 GRAMS/KILOMETRE
     WEIGHTED MASS CO        1.56 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     219.15 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .59 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  12.1  KILOMETRE/LITRE
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TABLE A-25. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                              1975  LIGHT DUTY EMISSIONS TEST

UNIT NO. 001        TEST NO. 1          DATE  2/19/79                MFGR. CODE  900              YR.  1979
VEHICLE MODEL  OPEL 2100 D              ENGINE   2.07 LITRE 4        CURB WT.  1250 KG
                                                                     Test Weight 1361 kg

BAROMETER 736.35 MM OF HG.
DRY BULB TEMP.    26.1 DEG. C                                  WET BULB TEMP  12.8 DEG. C
REL. HUMIDITY     18 PCT.                                       ABS. HUMIDITY    3.8 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                     1               2
     FINAL WT.,   GRAMS                       -0.00           -0.00
     INITIAL WT., GRAMS                       -0.00           -0.00
     DIFFERENCE   GRAMS                        0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 188.0 MM. H2O                         BLOWER INLET PRESS., G1 162.6 MM. H2O
                                                                   BLOWER INLET TEMP.    40 DEG. C
     BAG RESULTS
     BAG NO.                                       1               2               3
     BLOWER REVOLUTIONS                         5376            9166            5369
     HC    SAMPLE   METER READING/SCALE       19.8/3           7.5/3          19.9/3
     HC    SAMPLE   PPM                           59              30              59
     HC    BACKGRD  METER READING/SCALE        2.5/1           2.8/1           3.2/1
     HC    BACKGRD  PPM                            3               3               3
     CO    SAMPLE   METER READING/SCALE        6.2/3           3.8/3           5.6/3
     CO    SAMPLE   PPM                           93              57              89
     CO    BACKGRD  METER READING/SCALE        0.0/3           0.0/3           0.0/3
     CO    BACKGRD  PPM                            0               0               0
     CO2   SAMPLE   METER READING/SCALE       75.5/2          99.8/2          61.3/2
     CO2   SAMPLE   PERCENT                     2.29            1.85            1.78
     CO2   BACKGRD  METER READING/SCALE        2.1/2           1.3/2           1.8/2
     CO2   BACKGRD  PERCENT                      .05             .03             .09
     NOX   SAMPLE   METER READING/SCALE       26.5/3          16.1/3          22.9/3
     NOX   SAMPLE   PPM                         79.5            48.3            67.8
     NOX   BACKGRD  METER READING/SCALE         .3/3            .2/3            .2/3
     NOX   BACKGRD  PPM                           .9              .6              .6

     HC    CONCENTRATION PPM                      57              28              57
     CO    CONCENTRATION PPM                      88              55              80
     CO2   CONCENTRATION PCT                    2.25            1.28            1.75
     NOX   CONCENTRATION PPM                    78.8            47.8            66.7
     HC    MASS GRAMS                           1.30            1.19            1.37
     CO    MASS GRAMS                           9.30            9.56            3.91
     CO2   MASS GRAMS                        1731.59         1599.26         1393.90
     NOX   MASS GRAMS                           5.19            5.32            4.35

     WEIGHTED MASS HC        .21 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .72 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    257.70 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .83 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.9  KILOMETRE/LITRE
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TABLE A-26.              VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                           1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  001       TEST NO. 2          DATE  2/20/79                 MFGR. CODE  400               YR.  1973
VEHICLE MODEL  OPEL 2100 U              ENGINE   2.07 LITRE 4         CURB WT.  1250 KG
                                                                      Test Weight 1361 kg

BAROMETER 739.06 MM OF HG.                                         WET BULB TEMP  17.2 DEG. C
DRY BULB TEMP.    24.9 DEG. C                                       ABS. HUMIDITY   9.6 MILLIGRAMS/KG
REL. HUMIDITY      49 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                     1              2
     FINAL WT.,    GRAMS                      -0.00          -0.00
     INITIAL WT.,  GRAMS                      -0.00          -0.00
     DIFFERENCE    GRAMS                       0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                         0.00 GRAMS


EXHAUST EMISSIONS

                                                                   BLOWER INLET PRESS., G1 165.1 MM. H2O
     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                         BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                      1              2              3
     BLOWER REVOLUTIONS                        5367           9158           5358
     HC    SAMPLE  METER READING/SCALE       18.5/3          9.2/3         53.9/1
     HC    SAMPLE  PPM                           74             37             54
     HC    BACKGRD METER READING/SCALE        7.5/1          5.2/1          4.5/1
     HC    BACKGRD PPM                            8              5              5
     CO    SAMPLE  METER READING/SCALE        7.6/3          3.4/3          5.0/3
     CO    SAMPLE  PPM                          119             51             75
     CO    BACKGRD METER READING/SCALE         .8/3           .4/3          0.0/3
     CO    BACKGRD PPM                           12              6              0
     CO2   SAMPLE  METER READING/SCALE       72.5/2         41.0/2         60.0/2
     CO2   SAMPLE  PERCENT                     2.18           1.13           1.74
     CO2   BACKGRD METER READING/SCALE        1.5/2          1.2/2          1.3/2
     CO2   BACKGRD PERCENT                      .04            .03            .03
     NOX   SAMPLE  METER READING/SCALE       24.1/3         14.6/3         21.7/3
     NOX   SAMPLE  PPM                         72.3           43.8           65.1
     NOX   BACKGRD METER READING/SCALE         .3/3           .3/3           .4/3
     NOX   BACKGRD PPM                           .9             .9            1.2

     HC    CONCENTRATION PPM                     68             32             50
     CO    CONCENTRATION PPM                     98             43             71
     CO2   CONCENTRATION PCT                   2.15           1.10           1.71
     NOX   CONCENTRATION PPM                   71.5           43.0           64.1
     HC    MASS GRAMS                          1.63           1.31           1.20
     CO    MASS GRAMS                          4.74           3.58           3.43
     CO2   MASS GRAMS                       1645.67        1438.44        1309.42
     NOX   MASS GRAMS                          5.50           5.63           4.91

     WEIGHTED MASS HC         .22 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .63 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     239.73 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.1  KILOMETRE/LITRE
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                        TABLE  A-27.          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                                          1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  001        TEST NO. 3          DATE  2/21/74                 MFGR. CODE  900                 YR.  1973
VEHICLE MODEL  OPEL 2100 D               ENGINE   2.07 LITRE 4         CURB WT.  1250 KG
                                                                       Test Weight  1361 kg
BAROMETER 735.33 MM OF HG.
DRY BULB TEMP.   21.7 DEG. C                                          WET BULB TEMP  11.7 DEG. C
REL. HUMIDITY     28 PCT.                                              ABS. HUMIDITY   4.6 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                       1              2
     FINAL WT.,   GRAMS                           -0.00          -0.00
     INITIAL WT., GRAMS                           -0.00          -0.00
     DIFFERENCE   GRAMS                            0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS
                                                                               0.00 GRAMS

EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS., G1 162.6 MM. H2O
     BLOWER DIF. PRESS., G2, 185.9 MM. H2O                             BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                         1              2              3
     BLOWER REVOLUTIONS                           5379           9191           5380
     HC   SAMPLE  METER READING/SCALE             18.1/3          7.3/3         14.8/3
     HC   SAMPLE  PPM                               72             29             59
     HC   BACKGRD METER READING/SCALE              2.5/1          2.5/1          3.0/1
     HC   BACKGRD PPM                                3              3              3
     CO   SAMPLE  METER READING/SCALE              5.5/3          2.9/3          4.5/3
     CO   SAMPLE  PPM                               82             43             67
     CO   BACKGRD METER READING/SCALE              0.0/3           .6/3           .2/3
     CO   BACKGRD PPM                                0              9              3
     CO2  SAMPLE  METER READING/SCALE             68.9/2         39.7/2         59.7/2
     CO2  SAMPLE  PERCENT                         2.05           1.09           1.73
     CO2  BACKGRD METER READING/SCALE              1.3/2          2.0/2          1.8/2
     CO2  BACKGRD PERCENT                          .03            .05            .03
     NOX  SAMPLE  METER READING/SCALE             22.6/3         14.4/3         21.7/3
     NOX  SAMPLE  PPM                             67.8           43.2           65.1
     NOX  BACKGRD METER READING/SCALE              .3/3           .1/3           .3/3
     NOX  BACKGRD PPM                               .9             .3             .9

     HC   CONCENTRATION PPM                         70             27             57
     CO   CONCENTRATION PPM                         78             34             62
     CO2  CONCENTRATION PCT                       2.02           1.04           1.70
     NOX  CONCENTRATION PPM                       67.0           42.9           64.3
     HC   MASS GRAMS                              1.69           1.11           1.37
     CO   MASS GRAMS                              3.81           2.79           3.01
     CO2  MASS GRAMS                           1557.92        1367.38        1312.59
     NOX  MASS GRAMS                              4.47           4.87           4.29

     WEIGHTED MASS HC         .22 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .51 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     230.82 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .77 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.6  KILOMETRE/LITRE
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TABLE A-28. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
1975 LIGHT DUTY EMISSIONS TEST

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UNIT NO.  001        TEST NO. 4          DATE  2/22/79                   MFGR. CODE  400               YR.  1973
VEHICLE MODEL  OPEL 2100 D               ENGINE   2.07 LITRE 4           CURB WT.  1250 KG
                                                                         Test Weight  1361 kg

BAROMETER 744.55 MM OF HG.                                              WET BULB TEMP  12.2 DEG. C
DRY BULB TEMP.    23.3 DEG. C                                            ABS. HUMIDITY   4.3 MILLIGRAMS/KG
REL. HUMIDITY      24 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1               2
     FINAL WT.,    GRAMS                    -0.00           -0.00
     INITIAL WT., GRAMS                     -0.00           -0.00
     DIFFERENCE    GRAMS                     0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                            0.00 GRAMS

EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS., G1 180.3 MM. H2O
     BLOWER DIF. PRESS., G2, 200.7 MM. H2O                             BLOWER INLET TEMP.    40 DEG. C

     BAG RESULTS
     BAG NO.                                    1               2               3
     BLOWER REVOLUTIONS                      5379            9164            5379
     HC    SAMPLE  METER READING/SCALE     22.5/3          10.4/3          16.4/3
     HC    SAMPLE  PPM                         90              42              66
     HC    BACKGRD METER READING/SCALE      2.0/1           2.0/1           4.0/1
     HC    BACKGRD PPM                          2               2               4
     CO    SAMPLE  METER READING/SCALE      6.7/3           3.1/3           4.7/3
     CO    SAMPLE  PPM                        100              46              70
     CO    BACKGRD METER READING/SCALE      1.9/3            .2/3           0.0/3
     CO    BACKGRD PPM                         28               3               0
     CO2   SAMPLE  METER READING/SCALE     72.0/2          40.9/2          60.6/2
     CO2   SAMPLE  PERCENT                   2.16            1.13            1.76
     CO2   BACKGRD METER READING/SCALE      1.8/2           1.8/2           2.5/2
     CO2   BACKGRD PERCENT                    .04             .04             .06
     NOX   SAMPLE  METER READING/SCALE     24.0/3          14.9/3          21.8/3
     NOX   SAMPLE  PPM                       72.0            44.7            65.4
     NOX   BACKGRD METER READING/SCALE      1.0/3            .7/3            .4/3
     NOX   BACKGRD PPM                        3.0             2.1             1.2

     HC    CONCENTRATION PPM                   88              40              62
     CO    CONCENTRATION PPM                   72              42              67
     CO2   CONCENTRATION PCT                 2.12            1.08            1.71
     NOX   CONCENTRATION PPM                 69.5            42.8            64.4
     HC    MASS GRAMS                        2.15            1.66            1.52
     CO    MASS GRAMS                        3.55            3.53            3.31
     CO2   MASS GRAMS                     1653.91         1440.60         1329.01
     NOX   MASS GRAMS                        4.69            4.87            4.30

     WEIGHTED MASS HC         .29 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .58 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     241.09 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .77 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.1  KILOMETRE/LITRE
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                    TABLE  A-29.          VEHICLE EMISSION RESULTS
                                      1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  001        TEST NO. 1          DATE  2/19/79                    MFGR. CODE  400              YR.  1973
VEHICLE MODEL  OPEL 2100 D               ENGINE   2.07 LITRE 4            CURB WT.  1260 KG
                                                                          Test Weight  1361 kg

BAROMETER 736.35 MM OF HG.                                              WET BULB TEMP  12.8 DEG. C
DRY BULB TEMP.   26.1 DEG. C                                             ABS. HUMIDITY   3.8 MILLIGRAMS/KG
REL. HUMIDITY      18 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                      1               2
     FINAL WT.,   GRAMS                        -0.00           -0.00
     INITIAL WT., GRAMS                        -0.00           -0.00
     DIFFERENCE   GRAMS                         0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS


EXHAUST EMISSIONS

                                                                   BLOWER INLET PRESS., G1 162.6 MM. H2O
     BLOWER DIF. PRESS., G2, 188.0 MM. H2O                         BLOWER INLET TEMP.    40 DEG. C

     BAG RESULTS
     BAG NO.                                       1               2               3
     BLOWER REVOLUTIONS                         5376            9166            5369
     HC   SAMPLE  METER READING/SCALE          3.3/3           1.9/3           3.3/3
     HC   SAMPLE  PPM                             33              19              32
     HC   BACKGRD METER READING/SCALE           .8/3            .8/3            .8/3
     HC   BACKGRD PPM                              8               8               8
     CO   SAMPLE  METER READING/SCALE          6.2/3           3.8/3           5.6/3
     CO   SAMPLE  PPM                             93              57              84
     CO   BACKGRD METER READING/SCALE          0.0/3           0.0/3           0.0/3
     CO   BACKGRD PPM                              0               0               0
     CO2  SAMPLE  METER READING/SCALE         75.5/2          44.8/2          61.3/2
     CO2  SAMPLE  PERCENT                       2.29            1.26            1.78
     CO2  BACKGRD METER READING/SCALE          2.1/2           1.3/2           1.8/2
     CO2  BACKGRD PERCENT                        .05             .03             .04
     NOX  SAMPLE  METER READING/SCALE         26.5/3          16.1/3          22.4/3
     NOX  SAMPLE  PPM                           79.5            48.3            67.2
     NOX  BACKGRD METER READING/SCALE           .3/3            .2/3            .2/3
     NOX  BACKGRD PPM                             .9              .6              .6

     HC   CONCENTRATION PPM                       26              12              26
     CO   CONCENTRATION PPM                       88              55              80
     CO2  CONCENTRATION PCT                     2.25            1.22            1.75
     NOX  CONCENTRATION PPM                     78.8            47.8            66.7
     HC   MASS GRAMS                             .64             .48             .63
     CO   MASS GRAMS                            4.30            4.56            3.91
     CO2  MASS GRAMS                         1731.53         1599.26         1343.09
     NOX  MASS GRAMS                            5.19            5.32            4.35

     WEIGHTED MASS HC        .09 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .72 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    257.70 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .83 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.4  KILOMETRE/LITRE
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                        TABLE  A-30.          VEHICLE EMISSION RESULTS
                                          1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  001         TEST NO. 2          DATE  2/20/79                     MFGR. CODE  400                  YR.  1973
VEHICLE MODEL  OPEL 2100 D                ENGINE   2.07 LITRE 4             CURB WT.  1260 KG
                                                                            Test Weight  1361 kg

BAROMETER 734.06 MM OF HG.
DRY BULB TEMP.    24.4 DEG. C                                              WET BULB TEMP  17.2 DEG. C
REL. HUMIDITY      49 PCT.                                                  ABS. HUMIDITY   9.6 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                      1              2
     FINAL WT.,    GRAMS                        -0.00          -0.00
     INITIAL WT., GRAMS                         -0.00          -0.00
     DIFFERENCE    GRAMS                         0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                            0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 190.5 MM. H2O                                  BLOWER INLET PRESS., G1 166.1 MM. H2O
                                                                            BLOWER INLET TEMP.   40 DEG. C
     BAG RESULTS
     BAG NO.                                       1              2              3
     BLOWER REVOLUTIONS                          6367           9182           5958
     HC    SAMPLE  METER READING/SCALE          9.5/3          2.3/3          3.5/3
     HC    SAMPLE  PPM                            95             23             35
     HC    BACKGRD METER READING/SCALE          1.1/3          1.2/3          1.1/3
     HC    BACKGRD PPM                            11             12             11
     CO    SAMPLE  METER READING/SCALE          7.6/3          3.4/3          5.0/3
     CO    SAMPLE  PPM                           114             61             76
     CO    BACKGRD METER READING/SCALE           .8/3           .4/3          0.0/3
     CO    BACKGRD PPM                            12              6              0
     CO2   SAMPLE  METER READING/SCALE         72.5/2         41.0/2         60.0/2
     CO2   SAMPLE  PERCENT                      2.18           1.13           1.79
     CO2   BACKGRD METER READING/SCALE          1.5/2          1.2/2          1.3/2
     CO2   BACKGRD PERCENT                       .04            .03            .03
     NOX   SAMPLE  METER READING/SCALE         24.1/3         14.6/3         21.7/3
     NOX   SAMPLE  PPM                          72.3           43.8           65.1
     NOX   BACKGRD METER READING/SCALE           .3/3           .3/3           .4/3
     NOX   BACKGRD PPM                            .9             .9            1.2

     HC    CONCENTRATION PPM                      36             12             26
     CO    CONCENTRATION PPM                      98             43             71
     CO2   CONCENTRATION PCT                    2.15           1.10           1.71
     NOX   CONCENTRATION PPM                    71.5           43.0           64.1
     HC    MASS GRAMS                            .86            .44            .61
     CO    MASS GRAMS                           4.74           3.58           3.43
     CO2   MASS GRAMS                        1695.66        1938.99        1309.92
     NOX   MASS GRAMS                           6.50           5.63           4.41

     WEIGHTED MASS HC         .10 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .63 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     239.73 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.2  KILOMETRE/LITRE
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                    TABLE  A-11.          VEHICLE EMISSION RESULTS
                                    1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.  001         TEST NO. 3          DATE  2/21/74                  MFGR. CODE  400                   YR.  1973
VEHICLE MODEL  OPEL 2100 D                ENGINE   2.07 LITRE 4          CURB WT.  1260 KG
                                                                          Test Weight 1361 kg

BAROMETER 735.33 MM OF HG.                                             WET BULB TEMP  11.7 DEG. C
DRY BULB TEMP.    21.7 DEG. C                                           ABS. HUMIDITY   4.6 MILLIGRAMS/KG
REL. HUMIDITY      28 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                        1              2
     FINAL WT.,    GRAMS                         -0.00          -0.00
     INITIAL WT.,  GRAMS                         -0.00          -0.00
     DIFFERENCE    GRAMS                          0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                           0.00 GRAMS

EXHAUST EMISSIONS

                                                                      BLOWER INLET PRESS., G1 162.6 MM. H2O
     BLOWER DIF. PRESS., G2, 185.9 MM. H2O                            BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                         1               2               3
     BLOWER REVOLUTIONS                           5379            9191            5388
     HC    SAMPLE  METER READING/SCALE             3.3/3           2.1/3           3.2/3
     HC    SAMPLE  PPM                              33              21              32
     HC    BACKGRD METER READING/SCALE              .4/3           1.2/3            .4/3
     HC    BACKGRD PPM                               4              12               4
     CO    SAMPLE  METER READING/SCALE             5.5/3           2.9/3           4.5/3
     CO    SAMPLE  PPM                              82              43              67
     CO    BACKGRD METER READING/SCALE             0.0/3            .6/3            .2/3
     CO    BACKGRD PPM                               0               4               3
     CO2   SAMPLE  METER READING/SCALE            68.4/2          39.7/2          59.7/2
     CO2   SAMPLE  PERCENT                        2.06            1.09            1.73
     CO2   BACKGRD METER READING/SCALE             1.3/2           2.0/2           1.3/2
     CO2   BACKGRD PERCENT                         .03             .05             .03
     NOX   SAMPLE  METER READING/SCALE            22.6/3          14.4/3          21.7/3
     NOX   SAMPLE  PPM                            67.8            43.2            65.1
     NOX   BACKGRD METER READING/SCALE              .3/3            .1/3            .3/3
     NOX   BACKGRD PPM                              .4              .3              .4

     HC    CONCENTRATION PPM                        30              10              29
     CO    CONCENTRATION PPM                        78              39              62
     CO2   CONCENTRATION PCT                      2.02            1.04            1.70
     NOX   CONCENTRATION PPM                      67.0            42.9            64.7
     HC    MASS GRAMS                              .72             .41             .68
     CO    MASS GRAMS                             3.81            2.79            3.01
     CO2   MASS GRAMS                          1557.92         1367.37         1312.58
     NOX   MASS GRAMS                             4.97            4.87            4.29

     WEIGHTED MASS HC         .09 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .61 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     230.82 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .77 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.6  KILOMETRE/LITRE
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TABLE A-32. VEHICLE EMISSION RESULTS
1975 LIGHT DUTY EMISSIONS TEST

```
UNIT NO. 001          TEST NO. 4            DATE  2/22/74                MFGR. CODE  400                YR.  1973
VEHICLE MODEL  OPEL 2100 D                  ENGINE   2.07 LITRE 4        CURB WT.  1250 KG
                                                                         Test Weight 1361 kg

BAROMETER 744,55 MM OF HG.                                            WET BULB TEMP  12,2 DEG. C
DRY BULB TEMP.   23,3 DEG. C                                           ABS. HUMIDITY   4,3 MILLIGRAMS/KG
REL. HUMIDITY     24 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                      1                2
     FINAL WT.,   GRAMS                        -0,00            -0,00
     INITIAL WT., GRAMS                        -0,00            -0,00
     DIFFERENCE   GRAMS                         0,00             0,00

     TOTAL EVAPORATIVE EMISSIONS                                          0,00 GRAMS

EXHAUST EMISSIONS

                                                                  BLOWER INLET PRESS., G1 180,3 MM. H2O
     BLOWER DIF. PRESS., G2, 200,7 MM. H2O                        BLOWER INLET TEMP.   40 DEG. C

     BAG RESULTS
     BAG NO.                                       1                2                3
     BLOWER REVOLUTIONS                         5874             9164             5874
     HC   SAMPLE  METER READING/SCALE          4.2/3            2.2/3            3.4/3
     HC   SAMPLE  PPM                             42               22               34
     HC   BACKGRD METER READING/SCALE          1.0/3            1.0/3            1.2/3
     HC   BACKGRD PPM                             10               10               12
     CO   SAMPLE  METER READING/SCALE          6.7/3            3.1/3            4.7/3
     CO   SAMPLE  PPM                            100               46               78
     CO   BACKGRD METER READING/SCALE          1.4/3             .2/3            0.0/3
     CO   BACKGRD PPM                             28                3                0
     CO2  SAMPLE  METER READING/SCALE         72.0/2           40.4/2           60.6/2
     CO2  SAMPLE  PERCENT                       2.16             1.13             1.76
     CO2  BACKGRD METER READING/SCALE          1.8/2            1.8/2            2.5/2
     CO2  BACKGRD PERCENT                        .04              .04              .06
     NOX  SAMPLE  METER READING/SCALE         24.0/3           14.4/3           21.8/3
     NOX  SAMPLE  PPM                           72.0             44.7             65.4
     NOX  BACKGRD METER READING/SCALE          1.0/3             .7/3             .4/3
     NOX  BACKGRD PPM                            3.0              2.1              1.2

     HC   CONCENTRATION PPM                       34               13               24
     CO   CONCENTRATION PPM                       72               42               67
     CO2  CONCENTRATION PCT                     2.12             1.08             1.71
     NOX  CONCENTRATION PPM                     69.5             42.8             64.4
     HC   MASS GRAMS                             .82              .53              .58
     CO   MASS GRAMS                            3.55             3.53             3.31
     CO2  MASS GRAMS                         1653.90          1440.60          1324.00
     NOX  MASS GRAMS                            4.64             4.87             4.30

     WEIGHTED MASS HC        .10 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .58 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    241.04 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .77 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.1  KILOMETRE/LITRE
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TABLE A-11. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
1975 LIGHT DUTY EMISSIONS TEST

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UNIT NO.              TEST NO. 3          DATE  9/18/79                  MFGR. CODE   31                  YR.  1979
VEHICLE MODEL  BLUE PHOCO CAPRI           ENGINE   2.3  LITRE 4          CURB WT.  1011 KG
                                                                         Test Weight 1134 kg

BAROMETER 742.95 MM OF HG.                                               WET BULB TEMP  18.9 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                             ABS. HUMIDITY  11.8 MILLIGRAMS/KG
REL. HUMIDITY      62 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                     1               2
     FINAL WT.,    GRAMS                      -0.00           -0.00
     INITIAL WT.,  GRAMS                      -0.00           -0.00
     DIFFERENCE    GRAMS                       0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                              0.00 GRAMS

EXHAUST EMISSIONS

                                                                         BLOWER INLET PRESS., G1 172.7 MM. H2O
     BLOWER DIF. PRESS., G2, 177.8 MM. H2O                               BLOWER INLET TEMP.   43 DEG. C

     BAG RESULTS
     BAG NO.                                      1               2               3
     BLOWER REVOLUTIONS                       10209           30508           10083
     HC    SAMPLE  METER READING/SCALE        8.0/5           2.1/2           6.1/2
     HC    SAMPLE  PPM                          128               9              18
     HC    BACKGRD METER READING/SCALE       10.0/2           9.0/2           9.0/2
     HC    BACKGRD PPM                           20              18              18
     CO    SAMPLE  METER READING/SCALE       70.0/1           6.0/1           4.0/1
     CO    SAMPLE  PPM                          327              19              13
     CO    BACKGRD METER READING/SCALE       10.0/1           7.0/1           3.5/1
     CO    BACKGRD PPM                           33              23              11
     CO2   SAMPLE  METER READING/SCALE       29.5/1          17.8/1          22.1/1
     CO2   SAMPLE  PERCENT                     2.23            1.56            1.98
     CO2   BACKGRD METER READING/SCALE          .8/1            .9/1            .8/1
     CO2   BACKGRD PERCENT                      .06             .07             .06
     NOX   SAMPLE  METER READING/SCALE       29.7/3          13.0/3          27.9/3
     NOX   SAMPLE  PPM                         89.1            39.0            82.2
     NOX   BACKGRD METER READING/SCALE        1.3/3            .9/3           1.0/3
     NOX   BACKGRD PPM                          3.9             2.7             3.0

     HC    CONCENTRATION PPM                    111             -12              -3
     CO    CONCENTRATION PPM                    279              -1               3
     CO2   CONCENTRATION PCT                   2.18            1.49            1.93
     NOX   CONCENTRATION PPM                   85.9            36.6            79.6
     HC    MASS GRAMS                          2.39            -.92            -.07
     CO    MASS GRAMS                         12.15            -.09             .12
     CO2   MASS GRAMS                       1998.01         1716.08         1312.91
     NOX   MASS GRAMS                          6.37            4.53            5.89

     WEIGHTED MASS HC        .05 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .93 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    257.99 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .88 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.9  KILOMETRE/LITRE
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TABLE A-34.   VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                        1975 LIGHT DUTY EMISSIONS TEST

```
UNIT NO.              TEST NO. 9          DATE  9/19/79                 MFGR. CODE   31              YR.  1979
VEHICLE MODEL  BLUE PROCO CAPRI           ENGINE    2.31 LITRE 4        CURB WT.  1011 KG
                                                                        Test Weight 1134 kg

BAROMETER 799.90 MM OF HG.                                            WET BULB TEMP  19.9 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                          ABS. HUMIDITY  12.5 MILLIGRAMS/KG
REL. HUMIDITY      66 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                     1               2
     FINAL WT.,   GRAMS                         -0.00           -0.00
     INITIAL WT., GRAMS                         -0.00           -0.00
     DIFFERENCE   GRAMS                          0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                                0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 185.9 MM. H2O                             BLOWER INLET PRESS., G1 170.2 MM. H2O
                                                                       BLOWER INLET TEMP.    98 DEG. C
     BAG RESULTS
     BAG NO.                                       1               2               3
     BLOWER REVOLUTIONS                         18050           30980           17997
     HC    SAMPLE  METER READING/SCALE            9.8/5           2.2/2           5.0/2
     HC    SAMPLE  PPM                            156               9              10
     HC    BACKGRD METER READING/SCALE            9.5/2           8.7/2           9.0/2
     HC    BACKGRD PPM                             19              17              18
     CO    SAMPLE  METER READING/SCALE           71.0/1           7.0/1           3.5/1
     CO    SAMPLE  PPM                            333              23              11
     CO    BACKGRD METER READING/SCALE           11.0/1           8.0/1           9.0/1
     CO    BACKGRD PPM                             37              26              13
     CO2   SAMPLE  METER READING/SCALE           72.5/2          61.3/2          66.3/2
     CO2   SAMPLE  PERCENT                       2.18            1.95            1.96
     CO2   BACKGRD METER READING/SCALE            .7/2           1.0/2           1.6/2
     CO2   BACKGRD PERCENT                        .02             .02             .09
     NOX   SAMPLE  METER READING/SCALE           29.8/3          12.0/3          26.9/3
     NOX   SAMPLE  PPM                           89.9            36.0            80.7
     NOX   BACKGRD METER READING/SCALE            1.0/3            .3/3            .5/3
     NOX   BACKGRD PPM                            3.0              .9             1.5

     HC    CONCENTRATION PPM                      190             -11              -5
     CO    CONCENTRATION PPM                      282              -1              -0
     CO2   CONCENTRATION PCT                     2.17            1.93            1.92
     NOX   CONCENTRATION PPM                     86.9            35.2            79.9
     HC    MASS GRAMS                            3.00            -.90            -.11
     CO    MASS GRAMS                           12.20            -.09            -.01
     CO2   MASS GRAMS                         1977.95         1698.23         1305.31
     NOX   MASS GRAMS                            6.55            9.98            5.96

     WEIGHTED MASS HC          .07 GRAMS/KILOMETRE
     WEIGHTED MASS CO          .93 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     250.89 GRAMS/KILOMETRE
     WEIGHTED MASS NOX         .89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.7  KILOMETRE/LITRE
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TABLE A-15. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                             1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.             TEST NO. 5          DATE  9/22/79                 MFGR. CODE   31                 YR.  1979
VEHICLE MODEL  BLUE PROCO CAPRI          ENGINE   2.3  LITRE 4         CURB WT.  1011 KG
                                                                       Test Weight 1134 kg

BAROMETER 739,14 MM OF HG.                                             WET BULB TEMP  19,4 DEG. C
DRY BULB TEMP.    25,0 DEG. C                                           ABS. HUMIDITY  12,1 MILLIGRAMS/KG
REL. HUMIDITY      60 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                    1              2
     FINAL WT.,    GRAMS                     -0,00          -0,00
     INITIAL WT.,  GRAMS                     -0,00          -0,00
     DIFFERENCE    GRAMS                      0,00           0,00

     TOTAL EVAPORATIVE EMISSIONS                                       0,00 GRAMS

EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS., G1 172,7 MM, H20
     BLOWER DIF. PRESS., G2, 182,9 MM, H20                             BLOWER INLET TEMP.    44 DEG. C

     BAG RESULTS
     BAG NO.                                     1              2              3
     BLOWER REVOLUTIONS                      17661          30485          18091
     HC    SAMPLE   METER READING/SCALE      8,0/6          1,9/2          3,9/2
     HC    SAMPLE   PPM                        257              4              8
     HC    BACKGRD METER READING/SCALE       7,0/2          4,0/2          3,0/2
     HC    BACKGRD PPM                          14              8              6
     CO    SAMPLE   METER READING/SCALE     85,5/1          1,0/1          1,0/1
     CO    SAMPLE   PPM                        446              3              3
     CO    BACKGRD METER READING/SCALE       4,0/1          1,0/1           ,5/1
     CO    BACKGRD PPM                          13              3              2
     CO2   SAMPLE   METER READING/SCALE     79,5/2         56,3/2         68,2/2
     CO2   SAMPLE   PERCENT                   2,25           1,62           2,03
     CO2   BACKGRD METER READING/SCALE       2,5/2          2,5/2          1,5/2
     CO2   BACKGRD PERCENT                    ,06            ,06            ,04
     NOX   SAMPLE   METER READING/SCALE     28,1/3         13,0/3         22,9/3
     NOX   SAMPLE   PPM                       84,3           39,0           68,7
     NOX   BACKGRD METER READING/SCALE        ,3/3           ,6/3           ,1/3
     NOX   BACKGRD PPM                          ,9            1,8             ,3

     HC    CONCENTRATION PPM                   245             -3              3
     CO    CONCENTRATION PPM                   407              0              2
     CO2   CONCENTRATION PCT                  2,20           1,56           1,99
     NOX   CONCENTRATION PPM                  83,6           37,4           68,4
     HC    MASS GRAMS                         5,06           -,12            ,06
     CO    MASS GRAMS                        16,97            ,02            ,07
     CO2   MASS GRAMS                      1448,19        1773,11        1343,27
     NOX   MASS GRAMS                         6,00           4,64           5,03

     WEIGHTED MASS HC        ,17 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,61 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    261,98 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       ,84 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10,2  KILOMETRE/LITRE
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                   TABLE A-36.        VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                  1975  LIGHT DUTY EMISSIONS TEST
UNIT NO.             TEST NO. 6        DATE  9/23/79
VEHICLE MODEL  BLUE PROCO CAPRI        ENGINE  2.31  LITRE 4           MFGR. CODE   31                  YR.  1979
                                                                       CURB WT.  1011 KG
                                                                       Test Weight 1134 kg
BAROMETER 749.05 MM OF HG.
DRY BULB TEMP.   23.9 DEG. C                                          WET BULB TEMP  18.9 DEG. C
REL. HUMIDITY     62 PCT.                                              ABS. HUMIDITY  11.7 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                               1              2
     FINAL WT.,    GRAMS                 -0.00          -0.00
     INITIAL WT.,  GRAMS                 -0.00          -0.00
     DIFFERENCE    GRAMS                  0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                     0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 177.8 MM. H2O                          BLOWER INLET PRESS., G1 172.7 MM. H2O
                                                                    BLOWER INLET TEMP.    44 DEG. C
     BAG RESULTS
     BAG NO.                                  1              2              3
     BLOWER REVOLUTIONS                   17907          30657          17959
     HC    SAMPLE  METER READING/SCALE      6.0/6          3.9/2          5.3/2
     HC    SAMPLE  PPM                      193              8             11
     HC    BACKGRD METER READING/SCALE      6.0/2          9.0/2          5.0/2
     HC    BACKGRD PPM                       12              8             10
     CO    SAMPLE  METER READING/SCALE     88.0/1           .5/1          16.0/1
     CO    SAMPLE  PPM                      968              2             55
     CO    BACKGRD METER READING/SCALE      1.5/1           .5/1           .5/1
     CO    BACKGRD PPM                        5              2              2
     CO2   SAMPLE  METER READING/SCALE     71.9/2         59.7/2         67.8/2
     CO2   SAMPLE  PERCENT                 2.19           1.56           2.01
     CO2   BACKGRD METER READING/SCALE      2.3/2          2.0/2          2.0/2
     CO2   BACKGRD PERCENT                  .06            .05            .05
     NOX   SAMPLE  METER READING/SCALE     28.9/3         19.8/3         30.2/3
     NOX   SAMPLE  PPM                     85.2           49.9           90.6
     NOX   BACKGRD METER READING/SCALE      .1/3           .8/3          1.3/3
     NOX   BACKGRD PPM                       .3            2.4            3.9

     HC    CONCENTRATION PPM                183              1              2
     CO    CONCENTRATION PPM                935              0             50
     CO2   CONCENTRATION PCT               2.09           1.52           1.97
     NOX   CONCENTRATION PPM               84.9           42.3           87.3
     HC    MASS GRAMS                      3.89            .03            .04
     CO    MASS GRAMS                     18.65            .01           2.15
     CO2   MASS GRAMS                   1915.73        1759.76        1335.76
     NOX   MASS GRAMS                      6.18           5.25           6.37

     WEIGHTED MASS HC        .19 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .77 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    258.95 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .96 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.3  KILOMETRE/LITRE
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                        TABLE  A-37.           VEHICLE EMISSION RESULTS
                                           1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.             TEST NO. 3           DATE  9/18/79                 MFGR. CODE   31                YR.  1979
VEHICLE MODEL  BLUE PROCO CAPRI           ENGINE   2.31  LITRE 4        CURB WT.  1011 KG
                                                                        Test Weight 1134 kg

BAROMETER 742.95 MM OF HG.                                            WET BULB TEMP  18.9 DEG. C
DRY BULB TEMP.   23.9 DEG. C                                           ABS. HUMIDITY  11.8 MILLIGRAMS/KG
REL. HUMIDITY      62 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                     1                 2
     FINAL WT.,    GRAMS                      -0.00             -0.00
     INITIAL WT., GRAMS                       -0.00             -0.00
     DIFFERENCE    GRAMS                       0.00              0.00

     TOTAL EVAPORATIVE EMISSIONS                                               0.00 GRAMS


EXHAUST EMISSIONS

                                                                      BLOWER INLET PRESS., G1 172.7 MM. H2O
     BLOWER DIF. PRESS., G2, 177.8 MM. H2O                            BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                      1                 2                 3
     BLOWER REVOLUTIONS                       18284             30508             18083
     HC    SAMPLE  METER READING/SCALE       12.2/3             2.1/3            24.2/2
     HC    SAMPLE  PPM                          122                21                24
     HC    BACKGRD METER READING/SCALE       22.1/2             1.9/3            21.3/2
     HC    BACKGRD PPM                           22                19                21
     CO    SAMPLE  METER READING/SCALE       70.0/1             6.0/1             4.0/1
     CO    SAMPLE  PPM                          327                19                13
     CO    BACKGRD METER READING/SCALE       10.0/1             7.0/1             3.5/1
     CO    BACKGRD PPM                           33                23                11
     CO2   SAMPLE  METER READING/SCALE       24.5/1            17.8/1            22.1/1
     CO2   SAMPLE  PERCENT                     2.23              1.56              1.98
     CO2   BACKGRD METER READING/SCALE         .8/1              .9/1              .8/1
     CO2   BACKGRD PERCENT                      .06               .07               .06
     NOX   SAMPLE  METER READING/SCALE       29.7/3            13.0/3            27.4/3
     NOX   SAMPLE  PPM                         89.1              39.0              82.2
     NOX   BACKGRD METER READING/SCALE        1.3/3              .9/3             1.0/3
     NOX   BACKGRD PPM                          3.9               2.7               3.0

     HC    CONCENTRATION PPM                    104                 4                 6
     CO    CONCENTRATION PPM                    279                -1                 3
     CO2   CONCENTRATION PCT                   2.18              1.49              1.93
     NOX   CONCENTRATION PPM                   85.9              36.6              79.6
     HC    MASS GRAMS                          2.24               .15               .13
     CO    MASS GRAMS                         12.15              -.09               .12
     CO2   MASS GRAMS                       1498.01           1715.09           1312.91
     NOX   MASS GRAMS                          6.37              4.53              5.85

     WEIGHTED MASS HC         .10 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .43 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     257.49 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .88 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.4  KILOMETRE/LITRE
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                    TABLE  A-38.          VEHICLE EMISSION RESULTS
                                       1975  LIGHT DUTY EMISSIONS TEST
UNIT NO.            TEST NO. 9         DATE  9/19/79
VEHICLE MODEL  BLUE PROCO CAPRI        ENGINE   2.31 LITRE 9          MFGR. CODE   31              YR.  1979
                                                                      CURB WT.  1011 KG
                                                                      Test Weight 1134 kg
BAROMETER 744.98 MM OF HG.
DRY BULB TEMP.    23.9 DEG. C                                        WET BULB TEMP  19.9 DEG. C
REL. HUMIDITY      66 PCT.                                            ABS. HUMIDITY  12.5 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,    GRAMS                      -0.00          -0.00
     INITIAL WT., GRAMS                       -0.00          -0.00
     DIFFERENCE    GRAMS                       0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                              0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 185.9 MM, H2O                          BLOWER INLET PRESS., G1 170.2 MM, H2O
                                                                     BLOWER INLET TEMP.    42 DEG. C
     BAG RESULTS
     BAG NO.                                     1              2              3
     BLOWER REVOLUTIONS                        18050          30980          17997
     HC   SAMPLE  METER READING/SCALE          10.9/3         19.1/2         16.8/2
     HC   SAMPLE  PPM                           109            19             17
     HC   BACKGRD METER READING/SCALE           3.0/3          1.6/3          1.7/3
     HC   BACKGRD PPM                            30             16             17
     CO   SAMPLE  METER READING/SCALE          71.0/1          7.0/1          3.5/1
     CO   SAMPLE  PPM                           333            23             11
     CO   BACKGRD METER READING/SCALE          11.0/1          8.0/1          9.0/1
     CO   BACKGRD PPM                            37             26             13
     CO2  SAMPLE  METER READING/SCALE          72.5/2         51.3/2         66.3/2
     CO2  SAMPLE  PERCENT                       2.18           1.95           1.96
     CO2  BACKGRD METER READING/SCALE            .7/2          1.0/2          1.6/2
     CO2  BACKGRD PERCENT                        .02            .08            .09
     NOX  SAMPLE  METER READING/SCALE          29.8/3         12.0/3         26.9/3
     NOX  SAMPLE  PPM                           89.9           36.0           80.7
     NOX  BACKGRD METER READING/SCALE           1.0/3           .3/3           .5/3
     NOX  BACKGRD PPM                            3.0             .9            1.5

     HC   CONCENTRATION PPM                      89             -0              2
     CO   CONCENTRATION PPM                     282             -1             -0
     CO2  CONCENTRATION PCT                     2.17           1.93           1.92
     NOX  CONCENTRATION PPM                     86.9           35.2           79.9
     HC   MASS GRAMS                            1.80           -.01            .05
     CO   MASS GRAMS                           12.20           -.09           -.01
     CO2  MASS GRAMS                         1977.95        1698.23        1305.31
     NOX  MASS GRAMS                            6.55           4.98           5.96

     WEIGHTED MASS HC        .07 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .93 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    250.89 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .89 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.7  KILOMETRE/LITRE
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                    TABLE A-39.          VEHICLE EMISSION RESULTS
                                    1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 5          DATE  9/22/79               MFGR. CODE   31                  YR.  1979
VEHICLE MODEL  BLUE PROCO CAPRI         ENGINE   2.3 LITRE 4         CURB WT.  1011 KG
                                                                    Test Weight 1134 kg

BAROMETER 739.14 MM OF HG.                                      WET BULB TEMP  19.4 DEG. C
DRY BULB TEMP.    25.0 DEG. C                                    ABS. HUMIDITY  12.1 MILLIGRAMS/KG
REL. HUMIDITY      60 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                  1          2
     FINAL WT.,    GRAMS                     -0.00      -0.00
     INITIAL WT.,  GRAMS                     -0.00      -0.00
     DIFFERENCE    GRAMS                      0.00       0.00

     TOTAL EVAPORATIVE EMISSIONS                                    0.00 GRAMS


EXHAUST EMISSIONS

                                                                BLOWER INLET PRESS., G1 172.7 MM. H2O
     BLOWER DIF. PRESS., G2, 102.9 MM. H2O                      BLOWER INLET TEMP.    49 DEG. C

     BAG RESULTS
     BAG NO.                                   1          2          3
     BLOWER REVOLUTIONS                      17661      30985      18091
     HC   SAMPLE  METER READING/SCALE        28.8/3     18.5/2     19.9/2
     HC   SAMPLE  PPM                         288         18         18
     HC   BACKGRD METER READING/SCALE         1.9/3     15.1/2     12.5/2
     HC   BACKGRD PPM                          19         15         13
     CO   SAMPLE  METER READING/SCALE        85.5/1      1.0/1      1.0/1
     CO   SAMPLE  PPM                         996          3          3
     CO   BACKGRD METER READING/SCALE         4.0/1      1.0/1       .8/1
     CO   BACKGRD PPM                          13          3          2
     CO2  SAMPLE  METER READING/SCALE        79.5/2     56.3/2     68.2/2
     CO2  SAMPLE  PERCENT                    2.25       1.62       2.03
     CO2  BACKGRD METER READING/SCALE         2.5/2      2.5/2      1.5/2
     CO2  BACKGRD PERCENT                     .06        .06        .05
     NOX  SAMPLE  METER READING/SCALE        28.1/3     13.0/3     22.9/3
     NOX  SAMPLE  PPM                        89.3       39.0       68.7
     NOX  BACKGRD METER READING/SCALE          .3/3       .6/3       .1/3
     NOX  BACKGRD PPM                          .9        1.8         .3

     HC   CONCENTRATION PPM                   272          5          4
     CO   CONCENTRATION PPM                   907          0          2
     CO2  CONCENTRATION PCT                  2.20       1.56       1.99
     NOX  CONCENTRATION PPM                  83.6       37.9       68.9
     HC   MASS GRAMS                         5.62        .19        .09
     CO   MASS GRAMS                        16.97        .02        .07
     CO2  MASS GRAMS                      1998.19    1778.12    1393.27
     NOX  MASS GRAMS                         6.00       4.69       5.03

     WEIGHTED MASS HC         .22 GRAMS/KILOMETRE
     WEIGHTED MASS C          .61 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    261.99 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .84 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.2  KILOMETRE/LITRE
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                     TABLE A-40.            VEHICLE EMISSION RESULTS
                                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.             TEST NO. 6          DATE  9/23/79                    MFGR. CODE   31                 YR.  1979
VEHICLE MODEL  BLUE PHOLO CAPRI          ENGINE   2.31 LITRE 4             CURB WT.  1011 KG
                                                                           Test Weight 1134 kg

BAROMETER 749.05 MM OF HG.                                               WET BULB TEMP  18.9 DEG. C
DRY BULB TEMP.   23.9 DEG. C                                              ABS. HUMIDITY  11.7 MILLIGRAMS/KG
REL. HUMIDITY      62 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                       1               2
     FINAL WT.,    GRAMS                        -0.00           -0.00
     INITIAL WT.,  GRAMS                        -0.00           -0.00
     DIFFERENCE    GRAMS                         0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                              0.00 GRAMS

EXHAUST EMISSIONS

                                                                      BLOWER INLET PRESS., G1 172.7 MM. H2O
     BLOWER DIF. PRESS., G2, 177.8 MM. H2O                            BLOWER INLET TEMP.    44 DEG. C

     BAG RESULTS
     BAG NO.                                        1               2               3
     BLOWER REVOLUTIONS                         17907           30557           17959
     HC    SAMPLE   METER READING/SCALE        17.6/3          13.0/2          16.5/2
     HC    SAMPLE   PPM                          176              19              16
     HC    BACKGRD  METER READING/SCALE         2.5/3          13.1/2          13.1/2
     HC    BACKGRD PPM                            25              13              13
     CO    SAMPLE   METER READING/SCALE        88.0/1            .5/1          16.0/1
     CO    SAMPLE   PPM                          968               2              55
     CO    BACKGRD  METER READING/SCALE         1.5/1            .5/1            .5/1
     CO    BACKGRD PPM                             5               2               2
     CO2   SAMPLE   METER READING/SCALE        71.9/2          59.7/2          67.8/2
     CO2   SAMPLE   PERCENT                     2.19            1.56            2.01
     CO2   BACKGRD  METER READING/SCALE         2.3/2           2.0/2           2.0/2
     CO2   BACKGRD PERCENT                       .06             .05             .05
     NOX   SAMPLE   METER READING/SCALE        28.9/3          19.8/3          30.2/3
     NOX   SAMPLE   PPM                         85.2            94.9            90.6
     NOX   BACKGRD  METER READING/SCALE          .1/3            .8/3           1.3/3
     NOX   BACKGRD PPM                            .3             2.9             3.9

     HC    CONCENTRATION PPM                     155               8               5
     CO    CONCENTRATION PPM                     935               0              50
     CO2   CONCENTRATION PCT                    2.09            1.52            1.97
     NOX   CONCENTRATION PPM                    84.9            92.3            87.3
     HC    MASS GRAMS                           3.29             .08             .11
     CO    MASS GRAMS                          18.65             .01            2.15
     CO2   MASS GRAMS                        1915.73         1759.76         1886.77
     NOX   MASS GRAMS                           6.18            5.85            6.37

     WEIGHTED MASS HC         .13 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .77 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     258.96 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .96 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.3  KILOMETRE/LITRE
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TABLE A-41.          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                        1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 1          DATE  7/31/79                   MFGR. CODE   -0                YR.  1979
VEHICLE MODEL  CRICKET DIESEL Tex. TCCS  ENGINE   2.11 LITRE 4          CURB WT.   1025 Kg
                                                                        Test Wt.  1134 Kg

BAROMETER 742.95 MM OF HG.                                             WET BULB TEMP  20.6 DEG. C
DRY BULB TEMP.   23.9 DEG. C                                            ABS. HUMIDITY  14.1 MILLIGRAMS/KG
REL. HUMIDITY     74 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,   GRAMS                       -0.00          -0.00
     INITIAL WT., GRAMS                       -0.00          -0.00
     DIFFERENCE   GRAMS                        0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS


EXHAUST EMISSIONS

                                                              BLOWER INLET PRESS., G1 101.6 MM. H2O
     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                    BLOWER INLET TEMP.   43 DEG. C

     BAG RESULTS
     BAG NO.                                    1              2              3
     BLOWER REVOLUTIONS                       5967           9981           5991
     HC   SAMPLE  METER READING/SCALE         25.9/5         36.1/3          5.8/6
     HC   SAMPLE  PPM                          918            109            187
     HC   BACKGRD METER READING/SCALE         11.0/1         11.0/1         12.0/1
     HC   BACKGRD PPM                           11             11             12
     CO   SAMPLE  METER READING/SCALE         16.7/3          2.7/3          7.3/3
     CO   SAMPLE  PPM                          286             90            110
     CO   BACKGRD METER READING/SCALE           .9/3           .7/3           .1/3
     CO   BACKGRD PPM                           13             10              1
     CO2  SAMPLE  METER READING/SCALE         63.1/2         65.1/3         86.7/3
     CO2  SAMPLE  PERCENT                     1.85           1.09           1.65
     CO2  BACKGRD METER READING/SCALE          9.5/3          9.6/3          9.9/3
     CO2  BACKGRD PERCENT                      .07            .07            .07
     NOX  SAMPLE  METER READING/SCALE         89.2/2         96.5/2         76.8/2
     NOX  SAMPLE  PPM                         89.2           96.5           76.8
     NOX  BACKGRD METER READING/SCALE           .2/3          0.0/3          0.0/3
     NOX  BACKGRD PPM                           .6            0.0            0.0

     HC   CONCENTRATION PPM                    905            139            176
     CO   CONCENTRATION PPM                    230             29            102
     CO2  CONCENTRATION PCT                   1.79           1.03           1.98
     NOX  CONCENTRATION PPM                   83.7           96.5           76.8
     HC   MASS GRAMS                         10.29           6.02           9.80
     CO   MASS GRAMS                         11.80           2.59           5.27
     CO2  MASS GRAMS                       1950.96        1926.30        1806.79
     NOX  MASS GRAMS                          7.93           7.58           7.31

     WEIGHTED MASS HC       1.06 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .88 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    226.90 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1.25 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.6  KILOMETRE/LITRE
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TABLE A-42. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
1975 LIGHT DUTY EMISSIONS TEST

UNIT NO. TEST NO. 2 DATE 8/ 1/79 MFGR. CODE -0 YR. 1979
VEHICLE MODEL CRICKET DIESEL Tex. TCCS ENGINE 2.31 LITRE 4 CURB WT. 1025 Kg
Test Wt. 1134 Kg.

BAROMETER 741.68 MM OF HG. WET BULB TEMP 24.9 DEG. C
DRY BULB TEMP. 27.2 DEG. C ABS. HUMIDITY 18.6 MILLIGRAMS/KG
REL. HUMIDITY 80 PCT.

EVAPORATIVE EMISSIONS

CANISTER	1	2
FINAL WT., GRAMS	-0.00	-0.00
INITIAL WT., GRAMS	-0.00	-0.00
DIFFERENCE GRAMS	0.00	0.00

TOTAL EVAPORATIVE EMISSIONS 0.00 GRAMS

EXHAUST EMISSIONS

BLOWER DIF. PRESS., G2, 127.0 MM. H2O
BLOWER INLET PRESS., G1 101.6 MM. H2O
BLOWER INLET TEMP. 43 DEG. C

BAG RESULTS

BAG NO.	1	2	3
BLOWER REVULUTIONS	5499	9305	6950
HC SAMPLE METER READING/SCALE	19.1/6	39.9/3	13.7/6
HC SAMPLE PPM	962	139	937
HC BACKGRD METER READING/SCALE	19.0/1	15.5/1	12.0/1
HC BACKGRD PPM	19	16	12
CO SAMPLE METER READING/SCALE	15.9/3	2.6/3	8.2/3
CO SAMPLE PPM	236	39	183
CO BACKGRD METER READING/SCALE	1.0/3	.8/3	.3/3
CO BACKGRD PPM	16	12	4
CO2 SAMPLE METER READING/SCALE	61.9/2	65.7/3	86.0/3
CO2 SAMPLE PERCENT	1.79	1.11	1.83
CO2 BACKGRD METER READING/SCALE	9.1/3	3.7/3	3.9/3
CO2 BACKGRD PERCENT	.06	.05	.05
NOX SAMPLE METER READING/SCALE	77.5/2	98.0/2	77.6/2
NOX SAMPLE PPM	77.5	98.0	77.6
NOX BACKGRD METER READING/SCALE	.7/2	1.0/2	1.7/2
NOX BACKGRD PPM	.7	1.0	1.7
HC CONCENTRATION PPM	936	125	926
CO CONCENTRATION PPM	209	26	113
CO2 CONCENTRATION PCT	1.79	1.06	1.79
NOX CONCENTRATION PPM	76.9	97.1	76.1
HC MASS GRAMS	11.10	5.91	10.78
CO MASS GRAMS	10.76	2.28	5.75
CO2 MASS GRAMS	1912.03	1959.39	1198.75
NOX MASS GRAMS	8.79	9.11	8.63

WEIGHTED MASS HC 1.35 GRAMS/KILOMETRE
WEIGHTED MASS CO .89 GRAMS/KILOMETRE
WEIGHTED MASS CO2 227.95 GRAMS/KILOMETRE
WEIGHTED MASS NOX 1.98 GRAMS/KILOMETRE

FUEL ECONOMY BY CARBON BALANCE = 11.5 KILOMETRE/LITRE

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                    TABLE  A-43.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 3          DATE  8/ 2/79                       MFGR. CODE   -0                TR,  1979
VEHICLE MODEL  CRICKET DIESEL Tex. TCCS  ENGINE   2.31 LITRE 4              CURB WT.  1025 Kg.
                                                                            Test Wt.  1134 Kg.

BAROMETER 790.91 MM OF HG.                                                 WET BULB TEMP  18.3 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                               ABS. HUMIDITY  11.1 MILLIGRAMS/KG
REL. HUMIDITY      59 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                        1              2
     FINAL WT.,   GRAMS                           -0.00          -0.00
     INITIAL WT., GRAMS                           -0.00          -0.00
     DIFFERENCE   GRAMS                            0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                              0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 119.3 MM, H2O                            BLOWER INLET PRESS., G1 101.6 MM, H2O
                                                                      BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                         1              2              3
     BLOWER REVOLUTIONS                           5580           9819           5966
     HC    SAMPLE  METER READING/SCALE           13.2/6         90.9/3         12.9/6
     HC    SAMPLE  PPM                            982            161            913
     HC    BACKGRD METER READING/SCALE           59.5/1         99.0/1         88.5/1
     HC    BACKGRD PPM                             59             99             83
     CO    SAMPLE  METER READING/SCALE           15.3/3          2.9/3          7.8/3
     CO    SAMPLE  PPM                            239             36            108
     CO    BACKGRD METER READING/SCALE             .1/3           .3/3           .3/3
     CO    BACKGRD PPM                              1              9              9
     CO2   SAMPLE  METER READING/SCALE           61.8/2         63.8/3         85.6/3
     CO2   SAMPLE  PERCENT                       1.80           1.07           1.52
     CO2   BACKGRD METER READING/SCALE           2.9/2          9.5/3          3.8/3
     CO2   BACKGRD PERCENT                        .07            .07            .06
     NOX   SAMPLE  METER READING/SCALE           83.3/2         96.0/2         75.1/2
     NOX   SAMPLE  PPM                           83.3           96.0           76.1
     NOX   BACKGRD METER READING/SCALE             .9/2          9.6/2          1.8/2
     NOX   BACKGRD PPM                             .9            9.6            1.8

     HC    CONCENTRATION PPM                      370            116            393
     CO    CONCENTRATION PPM                      228             30             99
     CO2   CONCENTRATION PCT                     1.79           1.01           1.47
     NOX   CONCENTRATION PPM                     82.5           91.8           79.0
     HC    MASS GRAMS                            9.59           5.16          10.00
     CO    MASS GRAMS                           11.95           2.70           5.07
     CO2   MASS GRAMS                         1928.03        1929.29        1193.08
     NOX   MASS GRAMS                            7.19           6.22           6.33

     WEIGHTED MASS HC        1.29 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .87 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     225.26 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       1.07 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.7  KILOMETRE/LITRE
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                         TABLE  A-44.        VEHICLE EMISSION RESULTS
                                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 1           DATE  7/31/79                        MFGR. CODE   -0                  YR.  1979
VEHICLE MODEL  CRICKET DIESEL  Tex. TCCS ENGINE    2.31 LITRE 1               CURB WT.  1025 Kg.
                                                                             Test Wt.   1134 Kg.

BAROMETER 742,95 MM OF HG.                                                WET BULB TEMP  20,6 DEG. C
DRY BULB TEMP.    23,9 DEG. C                                              ABS. HUMIDITY  19,1 MILLIGRAMS/KG
REL. HUMIDITY      74 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                          1              2
     FINAL WT.,    GRAMS                             -0,00          -0,00
     INITIAL WT.,  GRAMS                             -0,00          -0,00
     DIFFERENCE    GRAMS                              0,00           0,00

     TOTAL EVAPORATIVE EMISSIONS                                                 0,00 GRAMS

EXHAUST EMISSIONS

                                                                           BLOWER INLET PRESS., G1 101,6 MM. H2O
     BLOWER DIF. PRESS., G2, 127,0 MM. H2O                                 BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                           1              2              3
     BLOWER REVOLUTIONS                              5667           9381           8691
     HC    SAMPLE   METER READING/SCALE              22,6/3         59,3/2         10,1/3
     HC    SAMPLE   PPM                              226            59             101
     HC    BACKGRD  METER READING/SCALE              19,3/2         13,7/2         16,8/2
     HC    BACKGRD  PPM                              19             14             17
     CO    SAMPLE   METER READING/SCALE              16,7/3         2,7/3          7,3/3
     CO    SAMPLE   PPM                              286            40             110
     CO    BACKGRD  METER READING/SCALE              ,9/3           ,7/3           ,1/3
     CO    BACKGRD  PPM                              13             10             1
     CO2   SAMPLE   METER READING/SCALE              63,1/2         65,1/3         86,7/3
     CO2   SAMPLE   PERCENT                          1,85           1,09           1,88
     CO2   BACKGRD  METER READING/SCALE              9,5/3          9,6/3          9,9/3
     CO2   BACKGRD  PERCENT                          ,07            ,07            ,07
     NOX   SAMPLE   METER READING/SCALE              89,2/2         96,5/2         76,8/2
     NOX   SAMPLE   PPM                              89,2           96,5           76,8
     NOX   BACKGRD  METER READING/SCALE              ,2/3           0,0/3          0,0/3
     NOX   BACKGRD  PPM                              ,6             0,0            0,0

     HC    CONCENTRATION PPM                         219            47             86
     CO    CONCENTRATION PPM                         230            29             102
     CO2   CONCENTRATION PCT                         1,79           1,03           1,48
     NOX   CONCENTRATION PPM                         88,7           96,5           76,8
     HC    MASS GRAMS                                5,93           2,02           2,20
     CO    MASS GRAMS                                11,80          2,59           6,27
     CO2   MASS GRAMS                              1460,89        1926,25        1806,70
     NOX   MASS GRAMS                                7,93           7,62           7,31

     WEIGHTED MASS HC        ,47 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,88 GRAMS/KILOMETRE
     WEIGHTED MASS CO2   226,89 GRAMS/KILOMETRE
     WEIGHTED MASS NOX     1,25 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11,7  KILOMETRE/LITRE
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                    TABLE  A-45.            VEHICLE EMISSION RESULTS
                                        1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.              TEST NO. 2          DATE  8/ 1/79                          MFGR. CODE   -D                YR.  1979
VEHICLE MODEL  CRICKET DIESEL 1.4L TCCS  ENGINE   2.31  LITRE 4                  CURB WT.  1025 Kg
                                                                                 Test Wt.   1134 Kg.

BAROMETER 741,68 MM OF HG,
DRY BULB TEMP,   27,2 DEG, C                                                  WET BULB TEMP  24,4 DEG, C
REL, HUMIDITY     80 PCT,                                                      ABS, HUMIDITY  18,6 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                         1             2
     FINAL WT.,   GRAMS                            -0,00         -0,00
     INITIAL WT., GRAMS                            -0,00         -0,00
     DIFFERENCE   GRAMS                             0,00          0,00

     TOTAL EVAPORATIVE EMISSIONS                                                0,00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF, PRESS,, G2, 127,0 MM, H2O                                     BLOWER INLET PRESS,, G1 101,6 MM, H2O
                                                                               BLOWER INLET TEMP,    43 DEG, C
     BAG RESULTS
     BAG NO,                                          1             2             3
     BLOWER REVOLUTIONS                            8929          9305          5952
     HC   SAMPLE  METER READING/SCALE             23,7/3        81,3/2        11,3/3
     HC   SAMPLE  PPM                              237            81           113
     HC   BACKGRD METER READING/SCALE             19,9/2        19,9/2        19,3/2
     HC   BACKGRD PPM                               19            19            19
     CO   SAMPLE  METER READING/SCALE             15,9/3         2,6/3         8,2/3
     CO   SAMPLE  PPM                              236            39           133
     CO   BACKGRD METER READING/SCALE              1,0/3          ,8/3          ,3/3
     CO   BACKGRD PPM                               15            12             4
     CO2  SAMPLE  METER READING/SCALE             61,9/2        66,7/3        86,0/3
     CO2  SAMPLE  PERCENT                         1,79          1,11          1,89
     CO2  BACKGRD METER READING/SCALE              4,1/3         3,7/3         3,9/3
     CO2  BACKGRD PERCENT                          ,06           ,08           ,08
     NOX  SAMPLE  METER READING/SCALE             77,5/2        98,0/2        77,6/2
     NOX  SAMPLE  PPM                             77,5          98,0          77,6
     NOX  BACKGRD METER READING/SCALE              ,7/2         1,0/2         1,7/2
     NOX  BACKGRD PPM                               ,7           1,0           1,7

     HC   CONCENTRATION PPM                        220            69            96
     CO   CONCENTRATION PPM                        209            26           113
     CO2  CONCENTRATION PCT                       1,79          1,06          1,84
     NOX  CONCENTRATION PPM                       76,9          97,1          76,1
     HC   MASS GRAMS                              5,61          2,79          2,93
     CO   MASS GRAMS                             10,76          2,28          5,75
     CO2  MASS GRAMS                           1911,95       1959,31       1198,65
     NOX  MASS GRAMS                              8,79          9,11          8,63

     WEIGHTED MASS HC        ,54 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,84 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    227,44 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1,48 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11,7  KILOMETRE/LITRE
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                    TABLE  A-46.          VEHICLE EMISSION RESULTS
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO,             TEST NO, 3          DATE  8/ 2/79                  MFGR, CODE   *0                  YR,  1979
VEHICLE MODEL  CRICKET DIESEL Tex. TCCS ENGINE   2.31 LITRE 4           CURB WT, 1025 Kg.
                                                                        Test Wt.  1134 Kg.
BAROMETER 740,41 MM OF HG,
DRY BULB TEMP,    23,9 DEG, C                                    WET BULB TEMP  18,3 DEG, C
REL, HUMIDITY      59 PCT,                                        ABS, HUMIDITY  11,1 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                      1              2
     FINAL WT,,    GRAMS                        -0,00          -0,00
     INITIAL WT,,  GRAMS                        -0,00          -0,00
     DIFFERENCE    GRAMS                         0,00           0,00

     TOTAL EVAPORATIVE EMISSIONS                                               0,00 GRAMS

EXHAUST EMISSIONS

                                                                 BLOWER INLET PRESS,, G1 101,6 MM, H2O
     BLOWER DIF, PRESS,, G2, 114,3 MM, H2O                       BLOWER INLET TEMP,    43 DEG, C

     BAG RESULTS
     BAG NO,                                       1              2              3
     BLOWER REVOLUTIONS                          5580           9613           5455
     HC   SAMPLE  METER READING/SCALE          25,9/3         10,7/3         18,5/3
     HC   SAMPLE  PPM                            289            107            188
     HC   BACKGRD METER READING/SCALE          63,1/2         52,7/2         30,7/2
     HC   BACKGRD PPM                             63             53             31
     CO   SAMPLE  METER READING/SCALE          15,3/3          2,9/3          7,8/3
     CO   SAMPLE  PPM                            239             36            108
     CO   BACKGRD METER READING/SCALE            ,1/3           ,3/3           ,3/3
     CO   BACKGRD PPM                              1              4              4
     CO2  SAMPLE  METER READING/SCALE          61,0/2         63,0/3         88,6/3
     CO2  SAMPLE  PERCENT                       1,80           1,07           1,98
     CO2  BACKGRD METER READING/SCALE           2,9/2          4,5/3          3,0/3
     CO2  BACKGRD PERCENT                        ,07            ,07            ,05
     NOX  SAMPLE  METER READING/SCALE          83,3/2         46,0/2         75,1/2
     NOX  SAMPLE  PPM                           83,3           46,0           75,1
     NOX  BACKGRD METER READING/SCALE           ,9/2          4,6/2          1,2/2
     NOX  BACKGRD PPM                             ,9            4,6            1,2

     HC   CONCENTRATION PPM                      200             59             91
     CO   CONCENTRATION PPM                      220             30             99
     CO2  CONCENTRATION PCT                     1,79           1,01           1,97
     NOX  CONCENTRATION PPM                     82,5           41,8           74,0
     HC   MASS GRAMS                            5,19           2,59           2,31
     CO   MASS GRAMS                           11,95           2,70           5,07
     CO2  MASS GRAMS                         1927,95        1989,86        1198,92
     NOX  MASS GRAMS                            7,19           6,22           6,33

     WEIGHTED MASS HC        ,51 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,87 GRAMS/KILOMETRE
     WEIGHTED MASS CO2   225,25 GRAMS/KILOMETRE
     WEIGHTED MASS NOX     1,07 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11,8  KILOMETRE/LITRE
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                    TABLE  A-47.          VEHICLE EMISSION RESULTS - Continuous Heated FID/HC
                                    1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.             TEST NO. 1         DATE  7/25/74                       MFGR. CODE   40                 YR.  1974
VEHICLE MODEL  Cricket Gasoline Tex. TCCS  ENGINE  2.33  LITRE 4            CURB WT.   1025 Kg
                                                                            Test Wt.   1134 Kg

BAROMETER 746.76 MM OF HG.                                               WET BULB TEMP  18.3 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                             ABS. HUMIDITY  11.0 MILLIGRAMS/KG
REL. HUMIDITY      59 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1              2
     FINAL WT.,   GRAMS                      -0.00          -0.00
     INITIAL WT., GRAMS                      -0.00          -0.00
     DIFFERENCE   GRAMS                       0.00           0.00

     TOTAL EVAPORATIVE EMISSIONS                                        0.00 GRAMS

EXHAUST EMISSIONS

                                                                   BLOWER INLET PRESS., G1 171.6 MM. H2O
     BLOWER DIF. PRESS., G2. 187.0 MM. H2O                          BLOWER INLET TEMP.    49 DEG. C

     BAG RESULTS
     BAG NO.                                    1              2              3
     BLOWER REVOLUTIONS                      5983           9093           5983
     HC   SAMPLE  METER READING/SCALE      37.3/3         32.7/3         40.1/3
     HC   SAMPLE  PPM                        189            131            160
     HC   BACKGRD METER READING/SCALE      10.0/1          8.0/1         11.0/1
     HC   BACKGRD PPM                         10              8             11
     CO   SAMPLE  METER READING/SCALE       6.8/3          1.0/3          2.0/3
     CO   SAMPLE  PPM                         78             18             30
     CO   BACKGRD METER READING/SCALE        .2/2           .1/2           .1/2
     CO   BACKGRD PPM                          6              3              3
     CO2  SAMPLE  METER READING/SCALE      60.0/2         59.7/3         82.1/3
     CO2  SAMPLE  PERCENT                   1.79            .99           1.99
     CO2  BACKGRD METER READING/SCALE       3.9/2          3.3/2          3.1/2
     CO2  BACKGRD PERCENT                    .09            .08            .08
     NOX  SAMPLE  METER READING/SCALE      87.1/2         49.9/2         79.9/2
     NOX  SAMPLE  PPM                       87.1           49.9           79.9
     NOX  BACKGRD METER READING/SCALE        .2/3           .1/3           .4/3
     NOX  BACKGRD PPM                         .6             .3            1.2

     HC   CONCENTRATION PPM                  180            124            150
     CO   CONCENTRATION PPM                   69             12             26
     CO2  CONCENTRATION PCT                 1.67            .91           1.90
     NOX  CONCENTRATION PPM                 86.6           49.1           78.3
     HC   MASS GRAMS                        3.58           5.25           3.83
     CO   MASS GRAMS                        3.54           1.00           1.33
     CO2  MASS GRAMS                     1959.90        1838.61        1117.93
     NOX  MASS GRAMS                        7.39           6.99           6.68

     WEIGHTED MASS HC        .79 GRAMS/KILOMETRE
     WEIGHTED MASS CO        .27 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    203.92 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1.16 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.4  KILOMETRE/LITRE
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                        TABLE A-48.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                         1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.                TEST NO. 2          DATE  7/26/74                     MFGR. CODE   =0                  YR.  1974
VEHICLE MODEL  Cricket Gasoline Tex. TCCS   ENGINE   2.31 LITRE 4             CURB WT. 1025 Kg.
                                                                              Test Wt.  1134 Kg.
BAROMETER 746,76 MM OF HG.
DRY BULB TEMP.   23,3 DEG. C                                              WET BULB TEMP  18,9 DEG. C
REL. HUMIDITY      66 PCT.                                                 ABS. HUMIDITY  12,0 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                     1              2
     FINAL WT.,   GRAMS                       -0,00          -0,00
     INITIAL WT., GRAMS                       -0,00          -0,00
     DIFFERENCE   GRAMS                        0,00           0,00

     TOTAL EVAPORATIVE EMISSIONS                                      0,00 GRAMS

EXHAUST EMISSIONS

                                                                  BLOWER INLET PRESS., G1 101,6 MM. H2O
     BLOWER DIF. PRESS., G2, 127,0 MM. H2O                        BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                        1              2              3
     BLOWER REVOLUTIONS                          5678           9683           5678
     HC    SAMPLE  METER READING/SCALE         28,5/3         31,6/3         35,9/3
     HC    SAMPLE  PPM                            119            186            199
     HC    BACKGRD METER READING/SCALE         16,0/1         15,0/1         16,0/1
     HC    BACKGRD PPM                             16             15             16
     CO    SAMPLE  METER READING/SCALE          9,3/3           ,5/2          2,0/3
     CO    SAMPLE  PPM                             69             14             30
     CO    BACKGRD METER READING/SCALE           ,1/2           ,3/2           ,3/2
     CO    BACKGRD PPM                              3              6              6
     CO2   SAMPLE  METER READING/SCALE         61,0/2         69,9/3         88,1/3
     CO2   SAMPLE  PERCENT                       1,77           1,09           1,81
     CO2   BACKGRD METER READING/SCALE          2,2/2          2,0/2          2,9/2
     CO2   BACKGRD PERCENT                        ,05            ,05            ,06
     NOX   SAMPLE  METER READING/SCALE         91,5/2         56,2/2         84,5/2
     NOX   SAMPLE  PPM                           91,5           56,2           84,5
     NOX   BACKGRD METER READING/SCALE           ,8/3          1,3/3           ,9/3
     NOX   BACKGRD PPM                            2,9            3,9            2,7

     HC    CONCENTRATION PPM                      100            113            189
     CO    CONCENTRATION PPM                       58              6             21
     CO2   CONCENTRATION PCT                     1,73           1,04           1,76
     NOX   CONCENTRATION PPM                     89,0           52,6           82,1
     HC    MASS GRAMS                            2,65           5,08           3,93
     CO    MASS GRAMS                            3,11            ,54           1,11
     CO2   MASS GRAMS                         1960,80        1900,99        1232,91
     NOX   MASS GRAMS                            8,21           8,21           7,54

     WEIGHTED MASS HC        ,68 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,21 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    234,65 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1,33 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9,9  KILOMETRE/LITRE
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                TABLE [illegible]          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                                   1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 3          DATE  7/29/74                   MFGR. CODE   40              YR.  1974
VEHICLE MODEL  Cricket Gasoline Ins. TCCS  ENGINE  [illegible]  LITRE 4   CURB WT.     1025 Kg.
                                                                        Test Wt.     1134 Kg.

BAROMETER 740.66 MM OF HG.                                            WET BULB TEMP  19.4 DEG. C
DRY BULB TEMP.    24.4 DEG. C                                          ABS. HUMIDITY  12.4 MILLIGRAMS/KG
REL. HUMIDITY      63 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1               2
     FINAL WT.,    GRAMS                    -0.00           -0.00
     INITIAL WT.,  GRAMS                    -0.00           -0.00
     DIFFERENCE    GRAMS                     0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                           0.00 GRAMS


EXHAUST EMISSIONS

                                                                      BLOWER INLET PRESS., G1 101.6 MM. H2O
     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                            BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                    1               2               3
     BLOWER REVOLUTIONS                      4457            9918            4567
     HC   SAMPLE  METER READING/SCALE      31.9/3          29.8/3          26.6/3
     HC   SAMPLE  PPM                         127             119             107
     HC   BACKGRD METER READING/SCALE      15.0/1          16.0/1          16.0/1
     HC   BACKGRD PPM                          15              16              16
     CO   SAMPLE  METER READING/SCALE       4.5/3            .8/3           1.4/3
     CO   SAMPLE  PPM                          67              12              28
     CO   BACKGRD METER READING/SCALE        .3/3            .4/3            .3/3
     CO   BACKGRD PPM                           4               6               4
     CO2  SAMPLE  METER READING/SCALE      59.0/2          64.6/3          52.2/2
     CO2  SAMPLE  PERCENT                    1.71            1.08            1.48
     CO2  BACKGRD METER READING/SCALE       2.1/2           3.8/3           2.2/2
     CO2  BACKGRD PERCENT                     .05             .05             .05
     NOX  SAMPLE  METER READING/SCALE      79.2/2          50.8/2          79.7/2
     NOX  SAMPLE  PPM                        79.2            50.8            79.7
     NOX  BACKGRD METER READING/SCALE        .9/2            .9/3           1.3/2
     NOX  BACKGRD PPM                          .9             1.2             1.3

     HC   CONCENTRATION PPM                   114             106              92
     CO   CONCENTRATION PPM                    60               6              23
     CO2  CONCENTRATION PCT                  1.66            1.03            1.43
     NOX  CONCENTRATION PPM                  78.4            49.7            78.5
     HC   MASS GRAMS                         2.89            4.86            2.38
     CO   MASS GRAMS                         3.05             .52            1.19
     CO2  MASS GRAMS                      1339.24         1922.51         1178.69
     NOX  MASS GRAMS                         6.95            7.92            7.10

     WEIGHTED MASS HC          .59 GRAMS/KILOMETRE
     WEIGHTED MASS CO          .21 GRAMS/KILOMETRE
     WEIGHTED MASS CO2      221.27 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        1.21 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  10.5  KILOMETRE/LITRE
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                    TABLE  A-50.          VEHICLE EMISSION RESULTS
                                       1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.               TEST NO. 1          DATE  7/25/79                       MFGR. CODE   -0                     YR.  1979
VEHICLE MODEL  CRICKET GASOLINE Tex. TCCSENGINE   2.31 LITRE 4                 CURB WT.    1025 Kg
                                                                               Test Wt.    1134 Kg.

BAROMETER 746.76 MM OF HG.                                                     WET BULB TEMP  18.3 DEG. C
DRY BULB TEMP.    23.9 DEG. C                                                   ABS. HUMIDITY  11.0 MILLIGRAMS/KG
REL. HUMIDITY      59 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                         1               2
     FINAL WT.,   GRAMS                           -0.00           -0.00
     INITIAL WT., GRAMS                           -0.00           -0.00
     DIFFERENCE   GRAMS                            0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS                                             0.00 GRAMS


EXHAUST EMISSIONS

                                                                        BLOWER INLET PRESS., G1 101.6 MM. H2O
     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                              BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                          1               2               3
     BLOWER REVOLUTIONS                            5453            9093            5453
     HC    SAMPLE  METER READING/SCALE           21.6/3          10.6/3          13.7/3
     HC    SAMPLE  PPM                              216             106             137
     HC    BACKGRD METER READING/SCALE            1.1/3           1.4/3           1.4/3
     HC    BACKGRD PPM                               11              14              14
     CO    SAMPLE  METER READING/SCALE            5.2/3           1.0/3           2.0/3
     CO    SAMPLE  PPM                               78              15              30
     CO    BACKGRD METER READING/SCALE             .2/2            .1/2            .1/2
     CO    BACKGRD PPM                                6               3               3
     CO2   SAMPLE  METER READING/SCALE           60.0/2          59.7/3          82.1/3
     CO2   SAMPLE  PERCENT                         1.74             .99            1.44
     CO2   BACKGRD METER READING/SCALE            3.4/2           3.3/2           3.1/2
     CO2   BACKGRD PERCENT                          .09             .08             .08
     NOX   SAMPLE  METER READING/SCALE           87.1/2          49.4/2          79.4/2
     NOX   SAMPLE  PPM                             87.1            49.4            79.4
     NOX   BACKGRD METER READING/SCALE             .2/3            .1/3            .4/3
     NOX   BACKGRD PPM                               .6              .3             1.2

     HC    CONCENTRATION PPM                        206              93             125
     CO    CONCENTRATION PPM                         69              12              26
     CO2   CONCENTRATION PCT                       1.67             .91            1.38
     NOX   CONCENTRATION PPM                       86.6            49.1            78.3
     HC    MASS GRAMS                              5.26            2.95            3.17
     CO    MASS GRAMS                              3.54            1.00            1.33
     CO2   MASS GRAMS                           1353.93         1236.59         1117.42
     NOX   MASS GRAMS                              7.39            6.99            6.68

     WEIGHTED MASS HC         .66 GRAMS/KILOMETRE
     WEIGHTED MASS CO         .27 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     203.41 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       1.16 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.4  KILOMETRE/LITRE
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                      TABLE A-51.        VEHICLE EMISSION RESULTS
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 2         DATE  7/26/79                     MFGR. CODE   -0                     YR.  1979
VEHICLE MODEL  CRICKET GASOLINE Tex. TCCS ENGINE    2.31 LITRE 4          CURB WT.  1025 Kg.
                                                                          Test Wt.   1134 Kg.

BAROMETER 746.76 MM OF HG.                                             WET BULB TEMP  18.9 DEG. C
DRY BULB TEMP.    23.3 DEG. C                                           ABS. HUMIDITY  12.0 MILLIGRAMS/KG
REL. HUMIDITY      66 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                   1               2
     FINAL WT.,   GRAMS                      -0,00           -0,00
     INITIAL WT., GRAMS                      -0,00           -0,00
     DIFFERENCE   GRAMS                       0,00            0,00

     TOTAL EVAPORATIVE EMISSIONS                                          0,00 GRAMS


EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS., G1 101,6 MM. H2O
     BLOWER DIF. PRESS., G2, 127,0 MM, H2O                             BLOWER INLET TEMP.    43 DEG. C

     BAG RESULTS
     BAG NO.                                    1               2               3
     BLOWER REVOLUTIONS                      5678            9683            5678
     HC    SAMPLE  METER READING/SCALE     20,2/3          12,9/3          13,7/3
     HC    SAMPLE  PPM                        202             129             137
     HC    BACKGRD METER READING/SCALE      1,8/3           2,5/3           2,1/3
     HC    BACKGRD PPM                         18              25              21
     CO    SAMPLE  METER READING/SCALE      4,3/3            ,5/2           2,0/3
     CO    SAMPLE  PPM                         64              14              30
     CO    BACKGRD METER READING/SCALE       ,1/2            ,3/2            ,3/2
     CO    BACKGRD PPM                          3               8               8
     CO2   SAMPLE  METER READING/SCALE     61,0/2          64,9/3          85,1/3
     CO2   SAMPLE  PERCENT                   1,77            1,09            1,51
     CO2   BACKGRD METER READING/SCALE      2,2/2           2,0/2           2,4/2
     CO2   BACKGRD PERCENT                    ,05             ,05             ,06
     NOX   SAMPLE  METER READING/SCALE     91,5/2          56,2/2          84,5/2
     NOX   SAMPLE  PPM                       91,5            56,2            84,5
     NOX   BACKGRD METER READING/SCALE       ,8/3           1,3/3            ,9/3
     NOX   BACKGRD PPM                        2,4             3,9             2,7

     HC    CONCENTRATION PPM                  186             106             118
     CO    CONCENTRATION PPM                   58               6              21
     CO2   CONCENTRATION PCT                 1,73            1,04            1,46
     NOX   CONCENTRATION PPM                 89,4            52,6            82,1
     HC    MASS GRAMS                        4,95            4,78            3,19
     CO    MASS GRAMS                        3,11             ,54            1,11
     CO2   MASS GRAMS                     1460,83         1500,99         1232,91
     NOX   MASS GRAMS                        8,21            8,21            7,54

     WEIGHTED MASS HC        ,72 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,21 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    234,65 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1,33 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9,9  KILOMETRE/LITRE
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TABLE A-51.

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                                     VEHICLE EMISSION RESULTS
                                 1975  LIGHT DUTY EMISSIONS TEST

UNIT NO,              TEST NO, 2          DATE  7/26/74                  MFGR, CODE   =0                 YR,  1974
VEHICLE MODEL  CRICKET GASOLINE Tex. TCCS ENGINE    2.31 LITRE 4         CURB WT,  1025 Kg.
                                                                         Test Wt.   1134 Kg.

BAROMETER 746,76 MM OF HG,                                             WET BULB TEMP  18,9 DEG, C
DRY BULB TEMP,    23,3 DEG, C                                           ABS, HUMIDITY  12,0 MILLIGRAMS/KG
REL, HUMIDITY      66 PCT,

EVAPORATIVE EMISSIONS

     CANISTER                                      1             2
     FINAL WT,,   GRAMS                         -0,00         -0,00
     INITIAL WT,, GRAMS                         -0,00         -0,00
     DIFFERENCE   GRAMS                          0,00          0,00

     TOTAL EVAPORATIVE EMISSIONS                                             0,00 GRAMS


EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS,, G1 101,6 MM, H2O
     BLOWER DIF, PRESS,, G2, 127,0 MM, H2O                             BLOWER INLET TEMP,   43 DEG, C

     BAG RESULTS
     BAG NO,                                       1             2             3
     BLOWER REVOLUTIONS                         5678          9683          5678
     HC   SAMPLE  METER READING/SCALE         20,2/3        12,9/3        13,7/3
     HC   SAMPLE  PPM                           202           129           137
     HC   BACKGRD METER READING/SCALE          1,8/3         2,5/3         2,1/3
     HC   BACKGRD PPM                            18            25            21
     CO   SAMPLE  METER READING/SCALE          4,3/3          ,5/2         2,0/3
     CO   SAMPLE  PPM                            64            14            30
     CO   BACKGRD METER READING/SCALE           ,1/2          ,3/2          ,3/2
     CO   BACKGRD PPM                             3             8             8
     CO2  SAMPLE  METER READING/SCALE         61,0/2        64,9/3        85,1/3
     CO2  SAMPLE  PERCENT                      1,77          1,09          1,51
     CO2  BACKGRD METER READING/SCALE          2,2/2         2,0/2         2,4/2
     CO2  BACKGRD PERCENT                       ,05           ,05           ,06
     NOX  SAMPLE  METER READING/SCALE         91,5/2        56,2/2        84,5/2
     NOX  SAMPLE  PPM                          91,5          56,2          84,5
     NOX  BACKGRD METER READING/SCALE           ,8/3         1,3/3          ,9/3
     NOX  BACKGRD PPM                           2,4           3,9           2,7

     HC   CONCENTRATION PPM                     186           106           118
     CO   CONCENTRATION PPM                      58             6            21
     CO2  CONCENTRATION PCT                    1,73          1,04          1,46
     NOX  CONCENTRATION PPM                    89,4          52,6          82,1
     HC   MASS GRAMS                           4,95          4,70          3,14
     CO   MASS GRAMS                           3,11           ,54          1,11
     CO2  MASS GRAMS                        1460,83       1500,99       1232,91
     NOX  MASS GRAMS                           8,21          8,21          7,54

     WEIGHTED MASS HC        ,72 GRAMS/KILOMETRE
     WEIGHTED MASS CO        ,21 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    234,65 GRAMS/KILOMETRE
     WEIGHTED MASS NOX      1,33 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9,9  KILOMETRE/LITRE
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TABLE A-52. VEHICLE EMISSION RESULTS
1975 LIGHT DUTY EMISSIONS TEST

UNIT NO. TEST NO. 3 DATE 7/29/74 MFGR. CODE -0 YR. 1974
VEHICLE MODEL CRICKET GASOLINE Tex. TCCS ENGINE 2.31 LITRE 4 CURB WT. 1025 Kg.
Test Wt. 1134 Kg.

BAROMETER 740,66 MM OF HG. WET BULB TEMP 19,4 DEG. C
DRY BULB TEMP. 24,4 DEG. C ABS. HUMIDITY 12,4 MILLIGRAMS/KG
REL. HUMIDITY 63 PCT.

EVAPORATIVE EMISSIONS

CANISTER	1	2
FINAL WT., GRAMS	-0,00	-0,00
INITIAL WT., GRAMS	-0,00	-0,00
DIFFERENCE GRAMS	0,00	0,00

TOTAL EVAPORATIVE EMISSIONS 0,00 GRAMS

EXHAUST EMISSIONS

BLOWER INLET PRESS., G1 101,6 MM. H2O
BLOWER DIF. PRESS., G2, 127,0 MM. H2O
BLOWER INLET TEMP. 43 DEG. C

BAG RESULTS

BAG NO.	1	2	3
BLOWER REVOLUTIONS	5457	9318	5567
HC SAMPLE METER READING/SCALE	24,4/3	12,2/3	15,5/3
HC SAMPLE PPM	244	122	155
HC BACKGRD METER READING/SCALE	1,6/3	1,5/3	1,6/3
HC BACKGRD PPM	16	15	16
CO SAMPLE METER READING/SCALE	4,5/3	,8/3	1,9/3
CO SAMPLE PPM	67	12	28
CO BACKGRD METER READING/SCALE	,3/3	,4/3	,3/3
CO BACKGRD PPM	4	6	4
CO2 SAMPLE METER READING/SCALE	59,0/2	44,6/3	52,2/2
CO2 SAMPLE PERCENT	1,71	1,08	1,48
CO2 BACKGRD METER READING/SCALE	2,1/2	3,8/3	2,2/2
CO2 BACKGRD PERCENT	,05	,05	,05
NOX SAMPLE METER READING/SCALE	79,2/2	50,8/2	79,7/2
NOX SAMPLE PPM	79,2	50,8	79,7
NOX BACKGRD METER READING/SCALE	,9/2	,4/3	1,3/2
NOX BACKGRD PPM	,9	1,2	1,3
HC CONCENTRATION PPM	230	108	141
CO CONCENTRATION PPM	60	6	23
CO2 CONCENTRATION PCT	1,66	1,03	1,43
NOX CONCENTRATION PPM	78,4	49,7	78,5
HC MASS GRAMS	5,82	4,67	3,63
CO MASS GRAMS	3,05	,52	1,19
CO2 MASS GRAMS	1339,28	1422,[illegible]1	1178,65
NOX MASS GRAMS	6,95	7,52	7,10

WEIGHTED MASS HC	,77	GRAMS/KILOMETRE
WEIGHTED MASS CO	,21	GRAMS/KILOMETRE
WEIGHTED MASS CO2	221,27	GRAMS/KILOMETRE
WEIGHTED MASS NOX	1,21	GRAMS/KILOMETRE

FUEL ECONOMY BY CARBON BALANCE = 10,5 KILOMETRE/LITRE

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                 TABLE  A-53.          VEHICLE EMISSION RESULTS - Continuous Heated FID-HC
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.              TEST NO. 1          DATE  7/25/74               MFGR. CODE    -0              YR.  1974
VEHICLE MODEL  HONDA-CVCC Civic           ENGINE   1.56  LITRE 4      CURB WT.      812 Kg.
                                                                      Test Wt.      907 Kg.

BAROMETER 746.76 MM OF HG.                                           WET BULB TEMP  18.3 DEG. C
DRY BULB TEMP.    22.8 DEG. C                                         ABS. HUMIDITY  11.5 MILLIGRAMS/KG
REL. HUMIDITY      65 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                    1             2
     FINAL WT.,    GRAMS                      -0.00         -0.00
     INITIAL WT., GRAMS                       -0.00         -0.00
     DIFFERENCE   GRAMS                        0.00          0.00

     TOTAL EVAPORATIVE EMISSIONS                                      0.00 GRAMS


EXHAUST EMISSIONS
                                                                 BLOWER INLET PRESS., G1 101.6 MM. H2O
     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                       BLOWER INLET TEMP.   43 DEG. C

     BAG RESULTS
     BAG NO.                                      1              2              3
     BLOWER REVOLUTIONS                         5507           9217           5455
     HC    SAMPLE  METER READING/SCALE          55.6/4         16.7/2         25.0/2
     HC    SAMPLE  PPM                           944             33             50
     HC    BACKGRD METER READING/SCALE          10.0/1          9.5/1          9.5/1
     HC    BACKGRD PPM                            10             10             10
     CO    SAMPLE  METER READING/SCALE          50.7/3         12.7/3         18.9/3
     CO    SAMPLE  PPM                           852            193            292
     CO    BACKGRD METER READING/SCALE           0.0/2          0.0/2          0.0/2
     CO    BACKGRD PPM                             0              0              0
     CO2   SAMPLE  METER READING/SCALE          56.9/2         69.8/3         85.7/3
     CO2   SAMPLE  PERCENT                      1.64           1.19           1.52
     CO2   BACKGRD METER READING/SCALE           2.8/2          2.5/2          2.6/2
     CO2   BACKGRD PERCENT                       .07            .06            .06
     NOX   SAMPLE  METER READING/SCALE          68.5/2         37.7/2         77.2/2
     NOX   SAMPLE  PPM                          68.5           37.7           77.2
     NOX   BACKGRD METER READING/SCALE            .4/3           .4/3           .2/3
     NOX   BACKGRD PPM                           1.2            1.2             .6

     HC    CONCENTRATION PPM                     936             25             42
     CO    CONCENTRATION PPM                     807            185            277
     CO2   CONCENTRATION PCT                    1.58           1.13           1.47
     NOX   CONCENTRATION PPM                    67.5           36.6           76.7
     HC    MASS GRAMS                          11.21           1.07           1.06
     CO    MASS GRAMS                          41.92          16.05          14.26
     CO2   MASS GRAMS                        1292.59        1552.33        1191.25
     NOX   MASS GRAMS                           5.91           5.37           6.65

     WEIGHTED MASS HC         .54 GRAMS/KILOMETRE
     WEIGHTED MASS CO        3.50 GRAMS/KILOMETRE
     WEIGHTED MASS CO2     230.96 GRAMS/KILOMETRE
     WEIGHTED MASS NOX        .97 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9.8  KILOMETRE/LITRE
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TABLE A-54. VEHICLE EMISSION RESULTS - Continuous Heated FID-HC

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                                        1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.            TEST NO. 2         DATE  7/26/79                    MFGR. CODE   -0              YR.  1979
VEHICLE MODEL  HONDA-CVCC Civic        ENGINE  1.56  LITRE 4            CURB WT.  812 Kg
                                                                        Test Wt.   907 Kg.

BAROMETER 746.76 MM OF HG.                                            WET BULB TEMP  19.4 DEG. C
DRY BULB TEMP.   23.9 DEG. C                                           ABS. HUMIDITY  12.5 MILLIGRAMS/KG
REL. HUMIDITY     66 PCT.

EVAPORATIVE EMISSIONS

     CANISTER                                  1                 2
     FINAL WT.,    GRAMS                     -0.00             -0.00
     INITIAL WT., GRAMS                      -0.00             -0.00
     DIFFERENCE    GRAMS                      0.00              0.00

     TOTAL EVAPORATIVE EMISSIONS                                          0.00 GRAMS


EXHAUST EMISSIONS

                                                                  BLOWER INLET PRESS., G1 101.6 MM. H2O
     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                         BLOWER INLET TEMP.   43 DEG. C

     BAG RESULTS
     BAG NO.                                   1                 2                 3
     BLOWER REVOLUTIONS                     5963              8625              5968
     HC   SAMPLE  METER READING/SCALE        67.5/4            24.0/2            30.1/2
     HC   SAMPLE  PPM                        540                48                60
     HC   BACKGRD METER READING/SCALE        15.0/1            13.0/1            13.0/1
     HC   BACKGRD PPM                         15                13                13
     CO   SAMPLE  METER READING/SCALE        51.5/3            12.5/3            17.9/3
     CO   SAMPLE  PPM                        867               190               276
     CO   BACKGRD METER READING/SCALE         .6/2              .5/2              .2/2
     CO   BACKGRD PPM                         17                14                 6
     CO2  SAMPLE  METER READING/SCALE        57.2/2            60.9/3            82.3/3
     CO2  SAMPLE  PERCENT                    1.65              1.01              1.45
     CO2  BACKGRD METER READING/SCALE         2.1/2             2.0/2             2.6/2
     CO2  BACKGRD PERCENT                     .05               .05               .06
     NOX  SAMPLE  METER READING/SCALE        74.7/2            35.0/2            75.9/2
     NOX  SAMPLE  PPM                        74.7              35.0              75.9
     NOX  BACKGRD METER READING/SCALE         .5/3              1.3/2             .3/3
     NOX  BACKGRD PPM                         1.5               1.3               .9

     HC   CONCENTRATION PPM                  527                36                49
     CO   CONCENTRATION PPM                  807               169               257
     CO2  CONCENTRATION PCT                  1.60              .97              1.39
     NOX  CONCENTRATION PPM                  73.4              33.8              75.1
     HC   MASS GRAMS                        13.45              1.45              1.24
     CO   MASS GRAMS                        41.57             13.79             13.27
     CO2  MASS GRAMS                      1302.90           1240.66           1133.23
     NOX  MASS GRAMS                        6.60              4.80              6.75

     WEIGHTED MASS HC        .66 GRAMS/KILOMETRE
     WEIGHTED MASS CO       3.25 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    202.76 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .95 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11.2  KILOMETRE/LITRE
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                        TABLE  A-55.          VEHICLE EMISSION RESULTS  - Continuous Heated FID-HC
                                           1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.              TEST NO. 3        DATE  7/29/74                        MFGR. CODE   -0              YR.  1974
VEHICLE MODEL  HONDA- CVCC Civic        ENGINE    1.56 LITRE 4               CURB WT.  812 Kg.
                                                                             Test Wt.   907 Kg.

BAROMETER 740.92 MM OF HG.                                                 WET BULB TEMP  17.8 DEG. C
DRY BULB TEMP.    23.3 DEG. C                                               ABS. HUMIDITY  10.7 MILLIGRAMS/KG
REL. HUMIDITY      58 PCT.

EVAPORATIVE EMISSIONS

    CANISTER                                          1             2
    FINAL WT.,   GRAMS                            -0.00         -0.00
    INITIAL WT., GRAMS                            -0.00         -0.00
    DIFFERENCE   GRAMS                             0.00          0.00

    TOTAL EVAPORATIVE EMISSIONS                                                0.00 GRAMS

EXHAUST EMISSIONS

    BLOWER DIF. PRESS., G2, 127.0 MM. H2O                               BLOWER INLET PRESS., G1 101.6 MM. H2O
                                                                        BLOWER INLET TEMP.   43 DEG. C
    BAG RESULTS
    BAG NO.                                          1              2              3
    BLOWER REVOLUTIONS                            5469           9311           5459
    HC    SAMPLE  METER READING/SCALE           56.9/4         15.9/2         22.7/2
    HC    SAMPLE  PPM                              452             32             45
    HC    BACKGRD METER READING/SCALE           14.0/1         13.0/1         11.0/1
    HC    BACKGRD PPM                               14             13             11
    CO    SAMPLE  METER READING/SCALE           42.7/3         13.1/3         17.7/3
    CO    SAMPLE  PPM                              702            199            273
    CO    BACKGRD METER READING/SCALE             .2/3          0.0/3           .8/3
    CO    BACKGRD PPM                                3              0             12
    CO2   SAMPLE  METER READING/SCALE           93.9/3         68.2/3         86.6/3
    CO2   SAMPLE  PERCENT                         1.70           1.16           1.54
    CO2   BACKGRD METER READING/SCALE            3.3/3          3.7/3          3.7/3
    CO2   BACKGRD PERCENT                          .05            .05            .05
    NOX   SAMPLE  METER READING/SCALE           68.7/2         35.5/2         76.9/2
    NOX   SAMPLE  PPM                             68.7           35.5           76.9
    NOX   BACKGRD METER READING/SCALE             .4/2           .6/2          0.0/2
    NOX   BACKGRD PPM                               .4             .6            0.0

    HC    CONCENTRATION PPM                        439             20             36
    CO    CONCENTRATION PPM                        663            191            249
    CO2   CONCENTRATION PCT                       1.66           1.11           1.50
    NOX   CONCENTRATION PPM                       68.4           35.0           76.9
    HC    MASS GRAMS                             11.13            .86            .90
    CO    MASS GRAMS                             33.91          16.66          12.72
    CO2   MASS GRAMS                           1337.29        1522.57        1207.07
    NOX   MASS GRAMS                              5.73           4.99           6.44

    WEIGHTED MASS HC        .51 GRAMS/KILOMETRE
    WEIGHTED MASS CO       3.19 GRAMS/KILOMETRE
    WEIGHTED MASS CO2    230.84 GRAMS/KILOMETRE
    WEIGHTED MASS NOX       .92 GRAMS/KILOMETRE

    FUEL ECONOMY BY CARBON BALANCE =   9.9  KILOMETRE/LITRE
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                    TABLE  A-56.          VEHICLE EMISSION RESULTS
                                   1975  LIGHT DUTY EMISSIONS TEST

UNIT NO,               TEST NO, 1       DATE  7/25/79                MFGR, CODE   -0                YR, 1979
VEHICLE MODEL  HONDA-CVCC Civic         ENGINE    1.56 LITRE 4       CURB WT,  812 Kg.
                                                                     Test Wt.   907 Kg.

BAROMETER 746,76 MM OF HG,                                         WET BULB TEMP  18,3 DEG, C
DRY BULB TEMP,   22,8 DEG, C                                        ABS, HUMIDITY  11,5 MILLIGRAMS/KG
REL, HUMIDITY     65 PCT,

EVAPORATIVE EMISSIONS

     CANISTER                                  1             2
     FINAL WT,,   GRAMS                    -0,00         -0,00
     INITIAL WT,, GRAMS                    -0,00         -0,00
     DIFFERENCE   GRAMS                     0,00          0,00

     TOTAL EVAPORATIVE EMISSIONS                                          0,00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF, PRESS,, G2, 127,0 MM, H2O                        BLOWER INLET PRESS,, G1 101,6 MM, H2O
                                                                  BLOWER INLET TEMP,   43 DEG, C
     BAG RESULTS
     BAG NO,                                   1             2             3
     BLOWER REVOLUTIONS                     5507          9817          5455
     HC    SAMPLE  METER READING/SCALF    52,3/3        39,1/2        57,7/2
     HC    SAMPLE  PPM                       583            39            88
     HC    BACKGRD METER READING/SCALE     1,1/3         2,9/3         1,3/3
     HC    BACKGRD PPM                        11            29            13
     CO    SAMPLE  METER READING/SCALE    50,7/3        12,7/3        18,9/3
     CO    SAMPLE  PPM                       852           193           292
     CO    BACKGRD METER READING/SCALE     0,0/2         0,0/2         0,0/2
     CO    BACKGRD PPM                         0             0             0
     CO2   SAMPLE  METER READING/SCALE    56,9/2        69,8/3        85,7/3
     CO2   SAMPLE  PERCENT                  1,64          1,19          1,88
     CO2   BACKGRD METER READING/SCALE     2,8/2         2,5/2         2,6/2
     CO2   BACKGRD PERCENT                   ,07           ,06           ,06
     NOX   SAMPLE  METER READING/SCALE    68,5/2        37,7/2        77,2/2
     NOX   SAMPLF  PPM                      68,5          37,7          77,2
     NOX   BACKGRD METER READING/SCALE      ,9/3          ,9/3          ,2/3
     NOX   BACKGRD PPM                       1,2           1,2            ,6

     HC    CONCENTRATION PPM                 513            12            96
     CO    CONCENTRATION PPM                 807           185           277
     CO2   CONCENTRATION PCT                1,58          1,13          1,97
     NOX   CONCENTRATION PPM                67,5          36,6          76,7
     HC    MASS GRAMS                      13,21           ,53          1,18
     CO    MASS GRAMS                      41,92         16,05         19,26
     CO2   MASS GRAMS                    1292,63       1552,33       1191,25
     NOX   MASS GRAMS                       5,91          5,37          6,65

     WEIGHTED MASS HC        ,57 GRAMS/KILOMETRE
     WEIGHTED MASS CO       3,50 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    230,97 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       ,97 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9,8  KILOMETRE/LITRE
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                     TABLE  A-57.        VEHICLE EMISSION RESULTS
                                     1975  LIGHT DUTY EMISSIONS TEST

UNIT NO,             TEST NO, 2          DATE  7/26/74                MFGR, CODE   =0                YR,  1974
VEHICLE MODEL  HONDA-CVCC Civic          ENGINE   1.56  LITRE 4         CURB WT,  812 Kg.
                                                                        Test Wt.   907 Kg.

BAROMETER 746,76 MM OF HG,                                             WET BULB TEMP  19,4 DEG, C
DRY BULB TEMP,   23,9 DEG, C                                            ABS, HUMIDITY  12,5 MILLIGRAMS/KG
REL, HUMIDITY     66 PCT,

EVAPORATIVE EMISSIONS

     CANISTER                                 1             2
     FINAL WT.,   GRAMS                   -0,00         -0,00
     INITIAL WT., GRAMS                   -0,00         -0,00
     DIFFERENCE   GRAMS                    0,00          0,00

     TOTAL EVAPORATIVE EMISSIONS                                        0,00 GRAMS


EXHAUST EMISSIONS

                                                                       BLOWER INLET PRESS., G1 101,6 MM, H2O
     BLOWER DIF, PRESS., G2, 127,0 MM, H2O                             BLOWER INLET TEMP,   43 DEG, C

     BAG RESULTS
     BAG NO,                                  1             2             3
     BLOWER REVOLUTIONS                    5463          8685          5468
     HC   SAMPLE  METER READING/SCALE    49,6/3        37,8/2        62,2/2
     HC   SAMPLE  PPM                       496            38            62
     HC   BACKGRD METER READING/SCALE     1,4/3         2,8/3         1,8/3
     HC   BACKGRD PPM                        14            20            18
     CO   SAMPLE  METER READING/SCALE    51,5/3        12,5/3        17,9/3
     CO   SAMPLE  PPM                       867           190           276
     CO   BACKGRD METER READING/SCALE      ,6/2          ,5/2          ,2/2
     CO   BACKGRD PPM                        17            14             6
     CO2  SAMPLE  METER READING/SCALE    57,2/2        60,9/3        82,3/3
     CO2  SAMPLE  PERCENT                  1,65          1,01          1,45
     CO2  BACKGRD METER READING/SCALE     2,1/2         2,0/2         2,6/2
     CO2  BACKGRD PERCENT                   ,05           ,05           ,06
     NOX  SAMPLE  METER READING/SCALE    74,7/2        35,0/2        75,9/2
     NOX  SAMPLE  PPM                      74,7          35,0          75,9
     NOX  BACKGRD METER READING/SCALE      ,5/3         1,3/2          ,3/3
     NOX  BACKGRD PPM                       1,5           1,3            ,9

     HC   CONCENTRATION PPM                 484            12            46
     CO   CONCENTRATION PPM                 807           169           257
     CO2  CONCENTRATION PCT                1,60           ,97          1,39
     NOX  CONCENTRATION PPM                73,4          33,8          75,1
     HC   MASS GRAMS                      12,35           ,48          1,18
     CO   MASS GRAMS                      41,57         13,79         13,27
     CO2  MASS GRAMS                    1302,89       1290,65       1133,23
     NOX  MASS GRAMS                       6,60          4,80          6,75

     WEIGHTED MASS HC        ,54 GRAMS/KILOMETRE
     WEIGHTED MASS CO       3,25 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    202,76 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       ,95 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =  11,2  KILOMETRE/LITRE
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                       TABLF   A-58.          VEHICLE EMISSION RESULTS
                                         1975  LIGHT DUTY EMISSIONS TEST

UNIT NO.              TEST NO. 3          DATE  7/29/74
VEHICLE MODEL  HONDA-CVCC Civic           ENGINE   1.56  LITRE 4          MFGR. CODE   -0                 YR.  1974
                                                                          CURB WT.  812 Kg.
                                                                          Test Wt.  907 Kg.
BAROMETER 740.92 MM OF HG.
DRY BULB TEMP.    23.3 DEG. C                                            WET BULB TEMP  17.8 DEG. C
REL. HUMIDITY      58 PCT.                                                ABS. HUMIDITY  10.7 MILLIGRAMS/KG

EVAPORATIVE EMISSIONS

     CANISTER                                        1               2
     FINAL WT.,    GRAMS                          -0.00           -0.00
     INITIAL WT., GRAMS                           -0.00           -0.00
     DIFFERENCE    GRAMS                           0.00            0.00

     TOTAL EVAPORATIVE EMISSIONS
                                                                              0.00 GRAMS

EXHAUST EMISSIONS

     BLOWER DIF. PRESS., G2, 127.0 MM. H2O                              BLOWER INLET PRESS., G1 101.6 MM. H2O
                                                                        BLOWER INLET TEMP.    43 DEG. C
     BAG RESULTS
     BAG NO.                                         1               2               3
     BLOWER REVOLUTIONS                           5469            9311            5459
     HC    SAMPLE  METER READING/SCALE            47.5/3          35.5/2          52.8/2
     HC    SAMPLE  PPM                            475             35              53
     HC    BACKGRD METER READING/SCALE             1.6/3           2.7/3           1.3/3
     HC    BACKGRD PPM                             16              27              13
     CO    SAMPLE  METER READING/SCALE            42.7/3          13.1/3          17.7/3
     CO    SAMPLE  PPM                            702             199             273
     CO    BACKGRD METER READING/SCALE             .2/3            0.0/3            .8/3
     CO    BACKGRD PPM                              3               0               12
     CO2   SAMPLE  METER READING/SCALE            93.4/3          68.2/3          86.6/3
     CO2   SAMPLE  PERCENT                        1.70            1.16            1.54
     CO2   BACKGRD METER READING/SCALE             3.3/3           3.7/3           3.7/3
     CO2   BACKGRD PERCENT                         .05             .05             .05
     NOX   SAMPLE  METER READING/SCALE            68.7/2          35.5/2          76.9/2
     NOX   SAMPLE  PPM                            68.7            35.5            76.9
     NOX   BACKGRD METER READING/SCALE             .4/2            .6/2            0.0/2
     NOX   BACKGRD PPM                              .4              .6             0.0

     HC    CONCENTRATION PPM                      461              11              41
     CO    CONCENTRATION PPM                      663             191             249
     CO2   CONCENTRATION PCT                      1.66            1.11            1.50
     NOX   CONCENTRATION PPM                      68.4            35.0            76.9
     HC    MASS GRAMS                            11.68             .47            1.05
     CO    MASS GRAMS                            33.91           16.66           12.72
     CO2   MASS GRAMS                          1337.25         1522.58         1207.07
     NOX   MASS GRAMS                             5.73            4.99            6.44

     WEIGHTED MASS HC        .50 GRAMS/KILOMETRE
     WEIGHTED MASS CO       3.19 GRAMS/KILOMETRE
     WEIGHTED MASS CO2    230.84 GRAMS/KILOMETRE
     WEIGHTED MASS NOX       .92 GRAMS/KILOMETRE

     FUEL ECONOMY BY CARBON BALANCE =   9.9  KILOMETRE/LITRE
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APPENDIX B

COMPUTER REDUCED
13-MODE RESULTS BY
CHASSIS VERSION OF 1974 HD FTP

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TABLE B-1. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2190-BUS CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-11-79 TEST-1 NISSAN DATSUN
DIESEL CAR 1981 52.2kw 4-Cycle 5-Speed Manual 2.17 litre 8.31 Bore 9.91 Stroke 22:1CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	1150	0.0	0.0	.013	1.11	1.12	.012
2	2400	0.0	0.0	.034	2.59	2.62	.013
3	2400	37.1	9.3	.058	2.61	2.66	.022
4	2400	73.1	18.4	.083	2.57	2.65	.032
5	2400	109.8	27.6	.109	2.51	2.62	.043
6	2400	145.3	36.5	.134	2.54	2.68	.053
7	1150	0.0	0.0	.014	1.12	1.13	.012
8	4000	124.6	52.2	.246	4.11	4.35	.060
9	4000	93.5	39.1	.206	3.96	4.17	.052
10	4000	62.3	26.1	.164	4.03	4.19	.041
11	4000	31.2	13.0	.123	4.09	4.21	.030
12	4000	0.0	0.0	.082	4.10	4.18	.020
13	1150	0.0	0.0	.014	1.12	1.14	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	64	194	84	0.00	*	*	*	6.0
2	96	403	52	0.00	*	*	*	6.0
3	76	156	234	.75	.63	2.59	6.52	6.0
4	68	106	304	1.47	.28	.88	4.24	6.0
5	76	122	320	2.21	.21	.67	2.04	6.0
6	120	265	323	2.92	.26	1.13	2.26	6.0
7	64	118	101	0.00	*	*	*	6.1
8	172	1478	914	4.18	.42	4.08	3.24	6.1
9	104	488	464	3.13	.32	3.01	4.70	6.1
10	80	254	412	2.09	.37	2.91	6.31	6.0
11	60	303	341	1.04	.56	5.68	4.55	6.0
12	92	550	154	0.00	*	*	*	6.0
13	98	147	71	0.00	*	*	*	6.0

CYCLE COMPOSITE BSHC = .455 GRAM/KW HR
BSCO* = 4.705 GRAM/KW HR
BSNO2** = 4.695 GRAM/KW HR
BSHC + BSNO2** = 5.150 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-2. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2190-BUS CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-11-79 TEST-2 NISSAN DATSUN
DIESEL CAR 1981 52.2kw 4-Cycle 5-Speed Manual 2.17 litre 8.31 Bore 9.91 Stroke 22:1CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	1150	0.0	0.0	.014	1.16	1.17	.012
2	2400	0.0	0.0	.034	2.59	2.62	.013
3	2400	37.1	9.3	.058	2.61	2.66	.022
4	2400	73.1	18.4	.083	2.57	2.65	.032
5	2400	109.8	27.6	.109	2.51	2.62	.043
6	2400	145.3	36.5	.134	2.54	2.68	.053
7	1150	0.0	0.0	.013	1.17	1.18	.011
8	4000	124.6	52.2	.246	4.11	4.36	.060
9	4000	93.5	39.1	.206	3.99	4.20	.052
10	4000	62.3	26.1	.164	4.02	4.19	.041
11	4000	31.2	13.0	.123	4.13	4.25	.030
12	4000	0.0	0.0	.082	4.12	4.20	.020
13	1150	0.0	0.0	.014	1.18	1.19	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	36	134	84	0.00	*	*	*	6.4
2	68	408	52	0.00	*	*	*	6.4
3	64	197	250	.75	.53	3.26	6.82	6.4
4	44	106	325	1.47	.18	.88	4.46	6.4
5	60	144	338	2.21	.17	.82	3.05	6.4
6	140	364	335	2.92	.36	1.48	2.34	6.4
7	40	122	92	0.00	*	*	*	6.5
8	144	1978	927	4.18	.35	4.67	3.34	6.5
9	120	631	485	3.13	.37	3.92	4.45	6.5
10	88	258	430	2.09	.41	2.40	6.56	6.5
11	60	303	327	1.04	.57	5.73	10.15	6.4
12	92	588	156	0.00	*	*	-	6.4
13	56	151	72	0.00	*	*	*	6.4

CYCLE COMPOSITE BSHC = .428 GRAM/KW HR
BSCO* = 5.134 GRAM/KW HR
BSNO2** = 4.897 GRAM/KW HR
BSHC + BSNO2** = 5.324 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-3. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2190-BUS CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-11-79 TEST-3 NISSAN DATSUN
DIESEL CAR 1981 52.2kw 4-Cycle 5-Speed Manual 2.17 litre 8.31 Bore 9.91 Stroke 22:1CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	1150	0.0	0.0	.014	1.16	1.17	.011
2	2400	0.0	0.0	.034	2.59	2.62	.013
3	2400	37.1	9.3	.058	2.58	2.64	.023
4	2400	73.1	18.4	.083	2.56	2.64	.032
5	2400	109.8	27.6	.109	2.50	2.61	.043
6	2400	145.3	36.5	.134	2.54	2.67	.053
7	1150	0.0	0.0	.014	1.18	1.14	.011
8	4000	124.6	52.2	.246	4.06	4.31	.061
9	4000	93.5	39.1	.206	3.95	4.16	.052
10	4000	62.3	26.1	.164	4.04	4.21	.041
11	4000	31.2	13.0	.123	4.08	4.20	.030
12	4000	0.0	0.0	.082	4.04	4.18	.020
13	1150	0.0	0.0	.014	1.17	1.19	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	24	127	48	0.00	*	*	*	6.6
2	64	374	52	0.00	*	*	*	6.6
3	52	196	248	.75	.43	3.23	6.68	6.6
4	36	106	314	1.47	.15	.88	4.37	6.6
5	60	188	333	2.21	.17	1.03	3.00	6.6
6	176	530	326	2.92	.37	2.25	2.27	6.5
7	36	135	82	0.00	*	*	*	6.5
8	160	1976	441	4.18	.38	4.46	3.47	6.5
9	128	543	488	3.13	.40	3.14	4.43	6.5
10	80	284	437	2.09	.38	2.65	6.71	6.4
11	56	303	324	1.04	.52	5.66	10.10	6.2
12	96	567	156	0.00	*	*	*	6.2
13	48	151	78	0.00	*	*	*	6.2

CYCLE COMPOSITE BSHC = .436 GRAM/KW HR
BSCO* = 5.142 GRAM/KW HR
BSNO2** = 4.897 GRAM/KW HR
BSHC + BSNO2** = 5.333 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

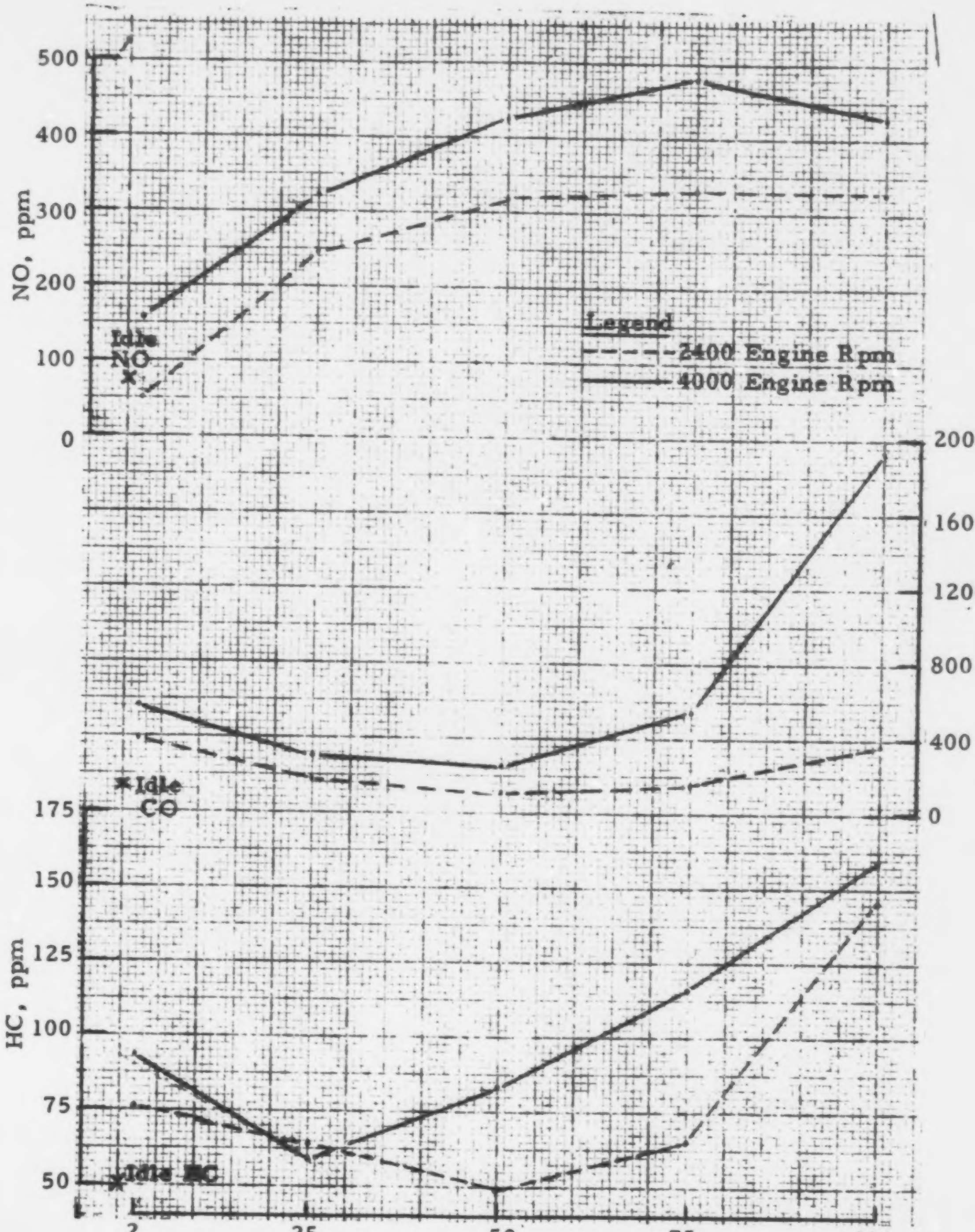

FIGURE B-1. GASEOUS EMISSIONS MAP OF NISSAN-DATSUN DIESEL CAR

TABLE B-4. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-21-79 TEST-1 MERCEDES
DIESEL CAW 0220 48.5kw 4-Cycle 4-Speed Auto 2.2 litre 8.71 Bore 9.25 Stroke 21:1 CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	836	0.0	0.0	.012	.81	.82	.015
2	2520	0.0	0.0	.034	2.58	2.61	.013
3	2520	27.1	7.2	.05[illegible]	2.62	2.67	.021
4	2520	54.3	14.3	.077	2.62	2.70	.029
5	2520	81.1	21.4	.102	2.59	2.69	.039
6	2520	108.2	28.6	.131	2.66	2.79	.049
7	836	0.0	0.0	.013	.81	.82	.016
8	4200	80.0	35.2	.208	4.15	4.36	.050
9	4200	60.0	26.4	.174	4.05	4.22	.043
10	4200	40.0	17.6	.142	4.05	4.19	.035
11	4200	20.0	8.8	.117	4.03	4.16	.029
12	4200	0.0	0.0	.092	4.04	4.13	.023
13	836	0.0	0.0	.012	.86	.87	.014

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	64	194	111	0.00	*	*	*	9.0
2	49	327	57	0.00	*	*	*	9.0
3	82	296	151	.57	.89	6.40	5.30	9.0
4	46	251	248	1.15	.25	2.76	4.45	9.0
5	48	210	369	1.71	.18	1.53	4.92	9.0
6	96	217	407	2.28	.27	1.23	3.78	8.7
7	68	186	121	0.00	*	*	*	8.7
8	72	328	494	2.82	.26	2.36	5.84	8.7
9	64	333	473	2.11	.30	3.09	7.20	8.7
10	60	428	368	1.41	.42	5.92	8.35	8.7
11	80	590	289	.70	1.10	16.13	12.73	8.5
12	109	775	174	0.00	*	*	*	8.5
13	76	183	118	0.00	*	*	*	8.5

CYCLE COMPOSITE BSHC = .474 GRAM/KW HR
BSCO* = 5.155 GRAM/KW HR
BSNO2**= 6.694 GRAM/KW HR
BSHC + BSNO2**= 7.168 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-5. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-21-79 TEST-2 MERCEDES
DIESEL CAW 0220 48.5kw 4-Cycle 4-Speed Auto 2.2 litre 8.71 Bore 9.25 Stroke 21:1CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	836	0.0	0.0	.011	.81	.82	.014
2	2520	0.0	0.0	.034	2.62	2.65	.013
3	2520	27.1	7.2	.054	2.62	2.68	.021
4	2520	54.3	14.3	.077	2.60	2.68	.030
5	2520	81.1	21.4	.102	2.55	2.65	.040
6	2520	108.2	28.6	.131	2.61	2.74	.050
7	836	0.0	0.0	.013	.81	.82	.016
8	4200	80.0	35.2	.208	4.13	4.34	.050
9	4200	60.0	26.4	.174	4.03	4.20	.043
10	4200	40.0	17.6	.142	4.02	4.16	.035
11	4200	20.0	8.8	.117	4.02	4.14	.029
12	4200	0.0	0.0	.092	4.02	4.12	.023
13	836	0.0	0.0	.013	.81	.82	.016

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	76	192	125	0.00	*	*	*	8.6
2	60	341	74	0.00	*	*	*	8.5
3	62	278	188	.57	.67	6.02	6.70	8.5
4	54	235	283	1.15	.29	2.55	5.05	8.5
5	54	213	403	1.71	.19	1.53	4.76	8.5
6	60	225	426	2.28	.17	1.25	3.90	8.3
7	80	178	127	0.00	*	*	*	8.3
8	64	328	507	2.82	.23	2.35	5.95	8.3
9	64	312	461	2.11	.30	2.88	7.00	8.3
10	64	380	379	1.41	.44	5.26	8.59	8.3
11	60	505	285	.70	.82	13.77	12.78	8.4
12	100	705	161	0.00	*	*	*	8.4
13	68	191	87	0.00	*	*	*	8.4

CYCLE COMPOSITE BSHC = .439 GRAM/KW HR
BSCO* = 4.909 GRAM/KW HR
BSNO2**= 6.865 GRAM/KW HR
BSHC + BSNO2**= 7.304 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-6. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13-MODE 3-MIN MODES 01-21-79 TEST-3 MERCEDES
DIESEL CAW 0220 48.5kw 4-Cycle 4-Speed Auto 2.2 litre 8.71 Bore 9.25 Stroke 21:1CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	836	0.0	0.0	.012	.81	.82	.015
2	2520	0.0	0.0	.034	2.57	2.60	.013
3	2520	27.1	7.2	.054	2.58	2.64	.021
4	2520	54.3	14.3	.077	2.57	2.64	.030
5	2520	81.1	21.4	.102	2.55	2.65	.040
6	2520	108.2	28.6	.131	2.60	2.73	.050
7	836	0.0	0.0	.011	.75	.77	.015
8	4200	80.0	35.2	.208	4.13	4.34	.050
9	4200	60.0	26.4	.174	4.03	4.20	.043
10	4200	40.0	17.6	.142	4.03	4.17	.035
11	4200	20.0	8.8	.117	4.03	4.15	.029
12	4200	0.0	0.0	.092	4.03	4.12	.023
13	836	0.0	0.0	.012	.81	.82	.015

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	72	208	128	0.00	*	*	*	8.5
2	56	341	60	0.00	*	*	*	8.5
3	56	282	188	.57	.60	6.03	6.60	8.5
4	50	268	276	1.15	.27	2.87	4.85	8.5
5	50	230	393	1.71	.18	1.65	4.64	8.7
6	56	233	421	2.28	.16	1.29	3.83	8.7
7	72	199	121	0.00	*	*	*	8.7
8	56	286	491	2.82	.20	2.04	5.76	8.7
9	46	270	472	2.11	.21	2.49	7.16	8.7
10	56	383	371	1.41	.39	5.27	8.38	8.7
11	80	580	273	.70	1.10	15.84	12.29	8.5
12	109	803	167	0.00	*	*	*	8.5
13	68	199	110	0.00	*	*	*	8.5

CYCLE COMPOSITE BSHC = .417 GRAM/KW HR
BSCO* = 4.973 GRAM/KW HR
BSNO2**= 6.746 GRAM/KW HR
BSHC + BSNO2**= 7.162 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

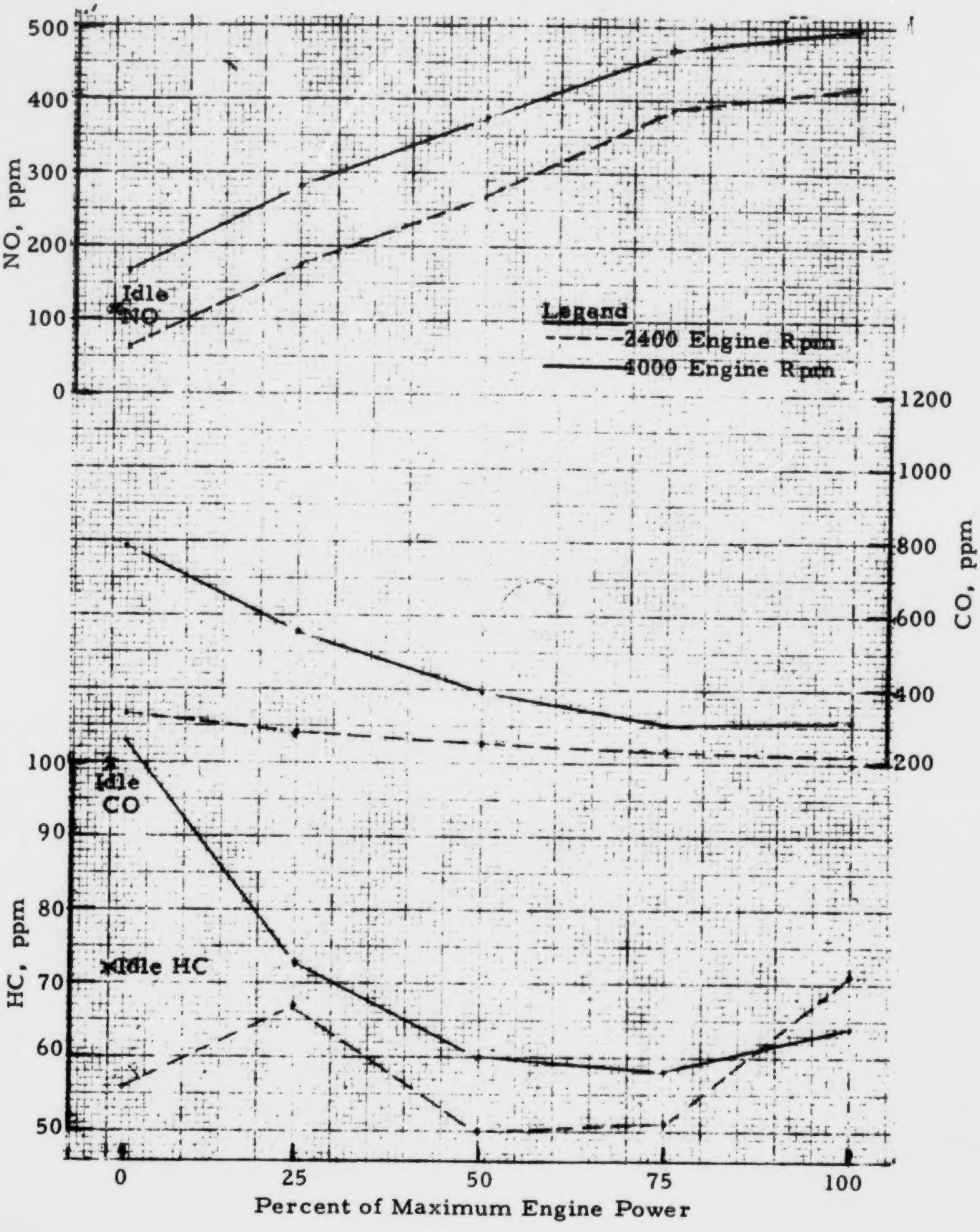

FIGURE B-2. GASEOUS EMISSIONS MAP OF MERCEDES 220D DIESEL CAR

TABLE B-7. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13 MODE 3-MIN MODES 3-8-79 TEST 1 PEUGEOT
DIESEL CAR 0504 52.2kw 4 Cycle 4-Speed Manual 2.11 litre 8.99 Bore 8.31 Stroke 22.2:1CR

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	750	0.0	0.0	.011	.90	.91	.012
2	2700	0.0	0.0	.040	3.00	3.04	.013
3	2700	30.3	8.6	.070	3.00	3.07	.023
4	2700	60.7	17.2	.101	3.00	3.10	.034
5	2700	91.0	25.7	.132	2.86	2.99	.046
6	2700	121.3	34.3	.162	2.86	3.02	.057
7	750	0.0	0.0	.011	.90	.91	.012
8	4500	101.8	47.9	.239	4.61	4.85	.052
9	4500	76.3	35.9	.204	4.52	4.72	.045
10	4500	51.0	24.0	.170	4.52	4.69	.038
11	4500	25.5	12.0	.135	4.52	4.65	.030
12	4500	0.0	0.0	.101	4.52	4.62	.022
13	750	0.0	0.0	.011	.90	.91	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	550	1113	21	0.00	*	*	*	19.5
2	1016	706	19	0.00	*	*	*	19.5
3	1309	510	50	.69	13.59	10.60	1.70	19.5
4	796	586	173	1.37	4.19	6.19	2.90	19.5
5	616	444	235	2.06	2.08	2.99	2.60	12.8
6	549	1186	244	2.74	1.39	6.04	2.05	12.8
7	996	603	65	0.00	*	*	*	12.8
8	776	975	297	3.84	2.28	5.71	2.86	12.8
9	1455	919	294	2.88	5.56	7.00	3.67	12.8
10	1492	413	251	1.92	8.47	4.67	4.48	13.3
11	1068	283	185	.96	12.09	6.37	6.83	13.3
12	768	350	121	0.00	*	*	*	13.3
13	909	1233	21	0.00	*	*	*	13.3

CYCLE COMPOSITE BSHC = 5.759 GRAM/KW HR
BSCO* = 7.440 GRAM/KW HR
BSNO2**= 3.534 GRAM/KW HR
BSHC + BSNO2**= 9.293 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-8. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13 MODE 3-MIN MODES 3-8-79 TEST 2 PEUGEOT
DIESEL CAR 0504 52.2kw 4Cycle 4-Speed Manual 2.11 litre 8.99 Bore 8.31 Stroke 22.2:1CR

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	750	0.0	0.0	.011	.90	.91	.012
2	2700	0.0	0.0	.040	2.99	3.03	.013
3	2700	30.3	8.6	.070	2.85	2.92	.025
4	2700	60.7	17.2	.101	2.85	2.95	.036
5	2700	91.0	25.7	.132	2.99	3.12	.044
6	2700	121.3	34.3	.162	2.85	3.01	.057
7	750	0.0	0.0	.011	.90	.91	.012
8	4500	101.8	47.9	.239	4.60	4.83	.052
9	4500	76.3	35.9	.204	4.51	4.71	.045
10	4500	51.0	24.0	.170	4.51	4.68	.038
11	4500	25.5	12.0	.135	4.51	4.64	.030
12	4500	0.0	0.0	.101	4.51	4.61	.022
13	750	0.0	0.0	.011	.90	.91	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	552	760	42	0.00	*	*	*	12.1
2	976	583	19	0.00	*	*	*	12.1
3	1296	482	83	.69	12.84	9.52	2.69	12.1
4	780	443	205	1.37	3.81	4.42	3.35	12.1
5	576	409	269	2.06	2.03	2.87	3.11	12.1
6	480	966	262	2.74	1.23	4.92	2.19	12.1
7	990	632	71	0.00	*	*	*	12.1
8	800	1118	291	3.84	2.36	6.59	2.79	12.1
9	1469	920	295	2.88	5.66	6.99	3.68	12.1
10	1480	419	262	1.92	8.39	4.67	4.67	11.8
11	1069	267	170	.96	11.97	5.97	6.27	11.8
12	789	323	109	0.00	*	*	*	11.8
13	992	1060	42	0.00	*	*	*	11.8

CYCLE COMPOSITE BSHC = 5.660 GRAM/KW HR
BSCO* = 7.032 GRAM/KW HR
BSNO2**= 3.657 GRAM/KW HR
BSHC + BSNO2**= 9.316 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-9. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13 MODE 3-MIN MODES 3-8-79 TEST 3 PEUGEOT
DIESEL CAR 0504 52.2kw 4 Cycle 4-Speed Manual 2.11 litre 8.99 Bore 8.31 Stroke 22.2:1CR

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	750	0.0	0.0	.011	.90	.91	.012
2	2700	0.0	0.0	.040	2.99	3.03	.013
3	2700	30.3	8.6	.070	2.99	3.06	.024
4	2700	60.7	17.2	.101	2.84	2.95	.036
5	2700	91.0	25.7	.132	2.84	2.98	.046
6	2700	121.3	34.3	.162	2.84	3.01	.057
7	750	0.0	0.0	.011	.90	.91	.012
8	4500	101.8	47.9	.239	4.59	4.83	.052
9	4500	76.3	35.9	.204	4.50	4.71	.045
10	4500	51.0	24.0	.170	4.50	4.67	.038
11	4500	25.5	12.0	.135	4.41	4.54	.031
12	4500	0.0	0.0	.101	4.41	4.51	.023
13	750	0.0	0.0	.011	.90	.91	.012

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	548	847	25	0.00	*	*	*	12.1
2	1056	645	19	0.00	*	*	*	12.1
3	1312	566	62	.69	13.61	11.99	2.11	12.1
4	832	485	179	1.37	4.16	4.83	2.93	12.1
5	656	448	267	2.06	2.21	3.00	2.94	11.9
6	608	1162	261	2.74	1.55	5.91	2.18	11.9
7	452	647	70	0.00	*	*	*	11.9
8	782	993	324	3.84	2.20	5.80	3.11	11.9
9	1440	989	328	2.88	5.44	7.51	4.09	11.9
10	1504	441	286	1.92	8.51	4.98	5.30	11.9
11	1072	309	220	.96	11.80	6.77	7.92	11.9
12	782	350	139	0.00	*	*	*	11.9
13	976	968	69	0.00	*	*	*	11.9

CYCLE COMPOSITE BSHC = 5.750 GRAM/KW HR
BSCO* = 7.420 GRAM/KW HR
BSNO2**= 3.951 GRAM/KW HR
BSHC + BSNO2**= 9.701 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

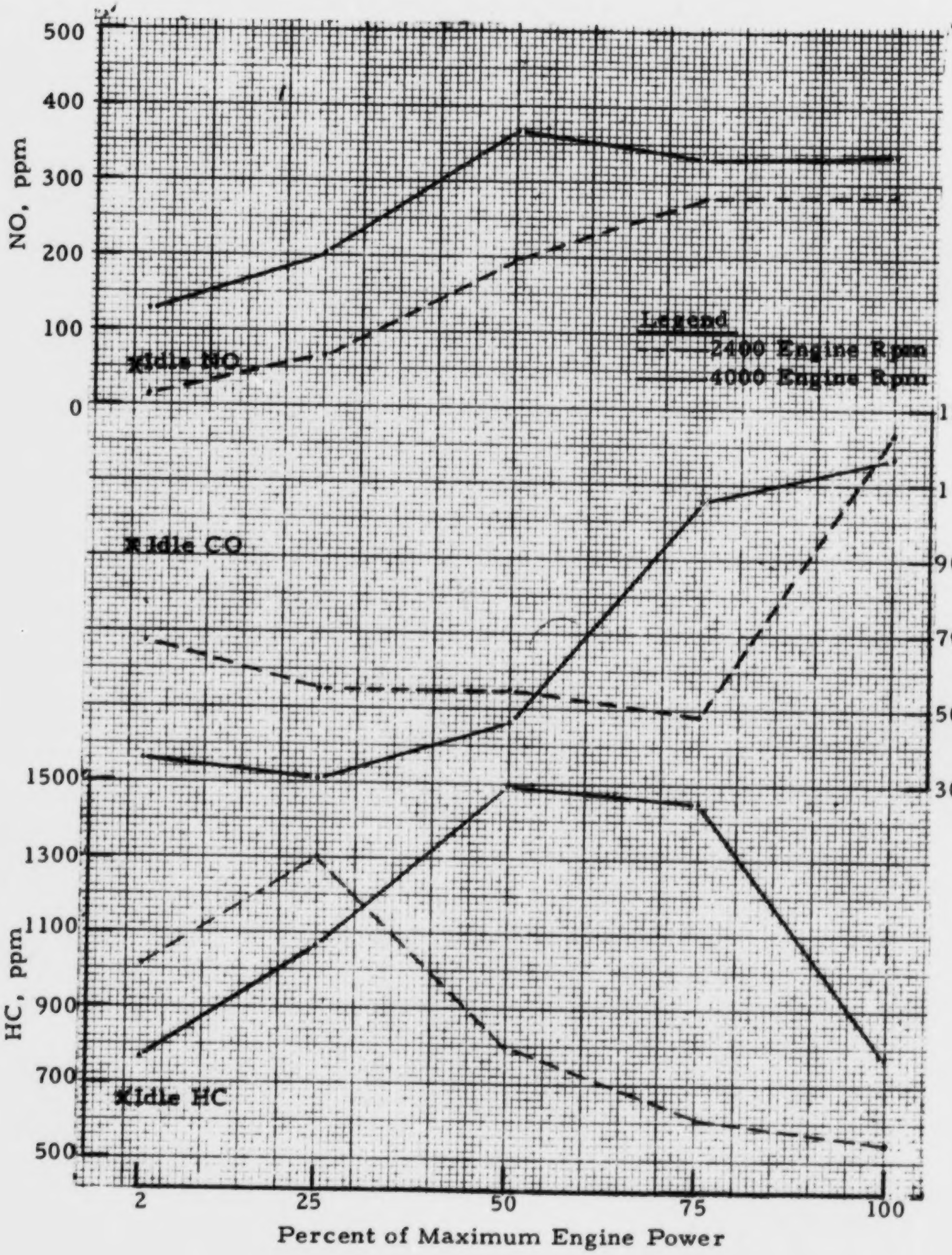

FIGURE B-3. GASEOUS EMISSIONS MAP OF
PEUGEOT 504D DIESEL CAR

Reproduced from best available copy.

TABLE B-10. 13-MODE FEDERAL DIESEL EMISSION CYCLE

13-CONTINUOUS CHASSIS SIMULATED 13 MODE 4-MIN MODES 3-22-79 TEST 1 OPEL
DIESEL CAR [illegible] Auto 2,07 litre 8,82 Bore 8,48 Stroke 22,0:1 CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	720	0,0	0,0	,009	1,28	1,29	,007
2	2580	0,0	0,0	,036	2,71	2,75	,013
3	2580	28,4	7,7	,055	2,71	2,77	,020
4	2580	56,9	15,4	,082	2,70	2,78	,030
5	2580	85,6	23,1	,107	2,55	2,66	,042
6	2580	114,0	30,8	,147	2,55	2,70	,058
7	720	0,0	0,0	,009	1,27	1,28	,007
8	4300	98,7	44,4	,264	4,22	4,48	,063
9	4300	74,0	33,3	,197	4,12	4,32	,048
10	4300	49,4	22,2	,156	4,20	4,36	,037
11	4300	24,7	11,1	,115	4,20	4,32	,027
12	4300	0,0	0,0	,085	4,22	4,30	,020
13	720	0,0	0,0	,009	1,27	1,28	,007

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	88	156	89	0,00	*	*	*	5,4
2	120	297	95	0,00	*	*	*	5,4
3	124	241	171	,61	1,30	5,02	5,85	5,4
4	124	161	299	1,23	,65	1,69	5,17	5,4
5	140	166	296	1,85	,47	1,10	4,29	4,7
6	152	447	230	2,46	,39	2,27	1,41	4,7
7	88	136	101	0,00	*	*	*	4,7
8	144	1872	290	3,56	,42	10,44	2,78	4,7
9	136	194	338	2,67	,51	1,46	4,17	4,7
10	124	167	320	1,78	,71	1,90	5,47	5,[illegible]
11	108	226	232	,89	1,22	4,47	4,58	5,[illegible]
12	106	275	183	0,00	*	*	*	5,[illegible]
13	88	156	89	0,00	*	*	*	5,[illegible]

CYCLE COMPOSITE BSHC = ,738 GRAM/KW HR
BSCO* = 4,929 GRAM/KW HR
BSNO2** = 4,662 GRAM/KW HR
BSHC + BSNO2** = 5,400 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-11. 13-MODE FEDERAL DIESEL EMISSION CYCLE

13-CONTINUOUS CHASSIS SIMULATED 13 MODE 4-MIN MODES 3-22-79 TEST 2 OPEL
DIESEL CAR [illegible] Auto 2,07 litre 8,82 Bore 8,48 Stroke 22,0:1 CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	720	0,0	0,0	,009	1,27	1,28	,007
2	2580	0,0	0,0	,036	2,70	2,74	,013
3	2580	28,4	7,7	,055	2,71	2,76	,020
4	2580	56,9	15,4	,082	2,70	2,78	,030
5	2580	85,6	23,1	,107	2,55	2,65	[illegible]
6	2580	114,0	30,8	,147	2,54	2,69	[illegible]
7	720	0,0	0,0	,009	1,27	1,28	,007
8	4300	98,7	44,4	,264	4,21	4,47	,063
9	4300	74,0	33,3	,197	4,11	4,31	,048
10	4300	49,4	22,2	,156	4,20	4,35	,037
11	4300	24,7	11,1	,115	4,19	4,31	,027
12	4300	0,0	0,0	,085	4,20	4,28	,020
13	720	0,0	0,0	,009	1,27	1,28	,007

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	76	187	44	0,00	*	*	*	5,3
2	124	324	63	0,00	*	*	*	5,3
3	124	271	164	,61	1,30	5,65	5,62	5,3
4	128	170	313	1,23	,67	1,78	5,49	5,3
5	156	174	333	1,85	,52	1,15	3,64	5,8
6	152	461	277	2,46	,39	2,33	2,[illegible]	5,8
7	84	156	122	0,00	*	*	*	5,8
8	160	1820	297	3,56	,47	10,61	2,44	5,8
9	152	218	349	2,67	,57	1,63	4,24	5,8
10	124	191	328	1,78	,71	2,17	6,11	6,0
11	96	237	292	,89	1,08	5,32	8,43	6,0
12	104	293	218	0,00	*	*	*	6,0
13	92	169	90	0,00	*	*	*	6,0

CYCLE COMPOSITE BSHC = ,758 GRAM/KW HR
BSCO* = 5,098 GRAM/KW HR
BSNO2** = 4,876 GRAM/KW HR
BSHC + BSNO2** = 5,634 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-12. 13-MODE FEDERAL DIESEL EMISSION CYCLE

13-CONTINUOUS CHASSIS SIMULATED 13 MODE 4-MIN MODES 3-22-79 TEST 3 OPEL
DIESEL CAR [illegible] Auto 2,07 litre 8,82 Bore 8,48 Stroke 22,0:1 CR

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	720	0,0	0,0	,009	1,27	1,28	,007
2	2580	0,0	0,0	,036	2,70	2,73	,013
3	2580	28,4	7,7	,055	2,70	2,75	,020
4	2580	56,9	15,4	,082	2,70	2,78	,030
5	2580	85,6	23,1	,107	2,54	2,65	,042
6	2580	114,0	30,8	,147	2,54	2,69	,058
7	720	0,0	0,0	,009	1,27	1,28	,007
8	4300	98,7	44,4	,264	4,21	4,47	,063
9	4300	74,0	33,3	,197	4,20	4,40	,047
10	4300	49,4	22,2	,156	4,20	4,36	,037
11	4300	24,7	11,1	,115	4,19	4,30	,027
12	4300	0,0	0,0	,085	4,19	4,27	,020
13	720	0,0	0,0	,009	1,26	1,27	,007

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	64	174	64	0,00	*	*	*	6,5
2	108	332	76	0,00	*	*	*	6,5
3	112	284	133	,61	1,17	5,90	4,56	6,5
4	112	173	262	1,23	,59	1,81	4,52	6,5
5	128	181	246	1,85	,43	1,21	3,22	6,3
6	120	478	266	2,46	,36	2,42	2,21	6,3
7	80	152	103	0,00	*	*	*	6,3
8	176	1968	303	3,56	,52	11,48	2,90	6,3
9	124	195	359	2,67	,48	1,49	4,52	6,3
10	108	184	331	1,78	,62	2,09	6,19	6,0
11	104	228	249	,89	1,17	5,13	9,18	6,0
12	108	284	185	0,00	*	*	*	6,0
13	92	152	103	0,00	*	*	*	6,0

CYCLE COMPOSITE BSHC = ,703 GRAM/KW HR
BSCO* = 5,272 GRAM/KW HR
BSNO2** = 4,726 GRAM/KW HR
BSHC + BSNO2** = 5,429 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

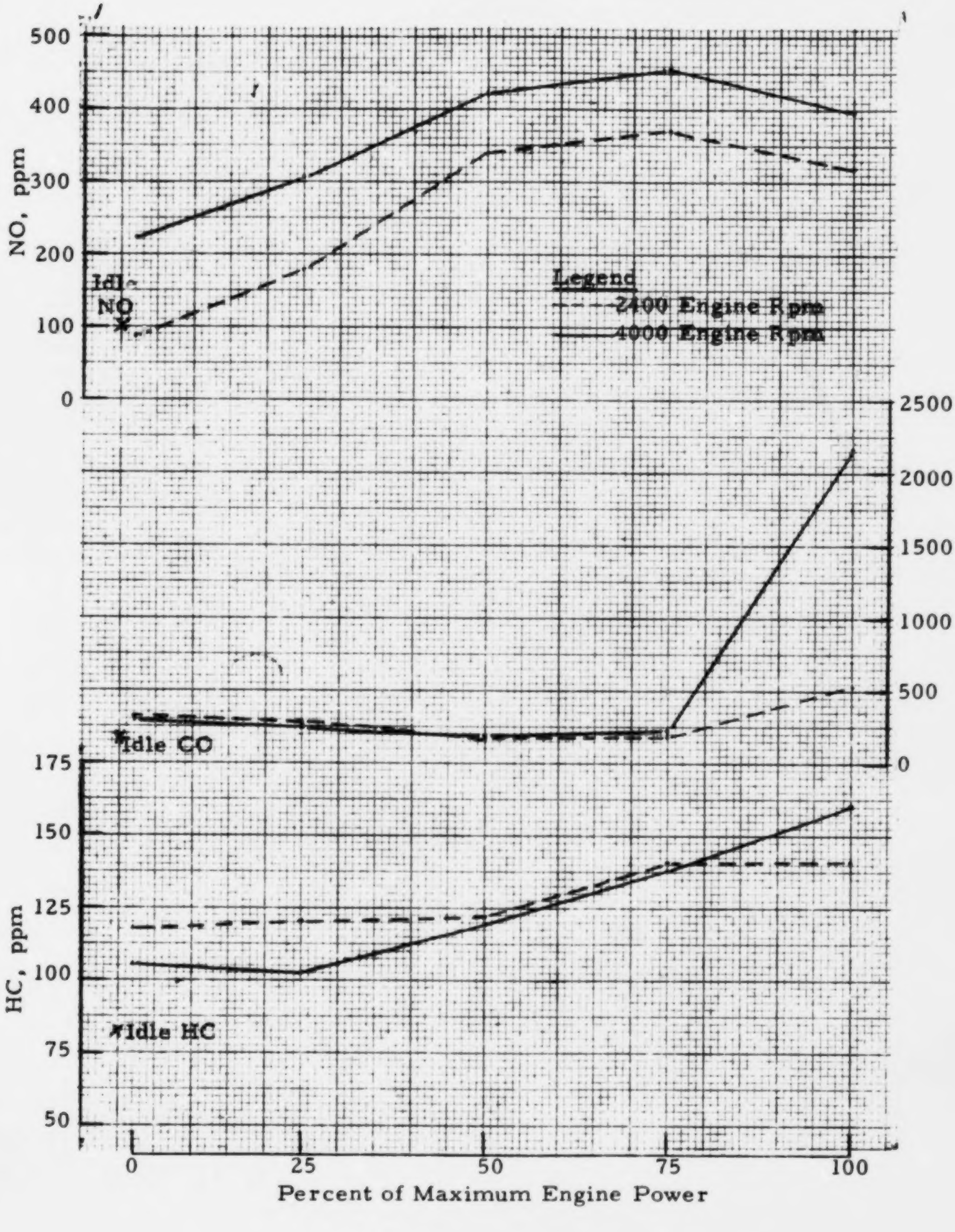

FIGURE B-4. GASEOUS EMISSIONS MAP OF OPEL REKORD DIESEL CAR

TABLE B-13. 13-MODE FEDERAL DIESEL EMISSION CYCLE

[illegible] CHASSIS SIMULATED 13 MODE 6-MIN MODES 6-19-79 TEST 3 FORD BLUE CAPRI
PROCO [illegible] LAM 71.52.2kw 4-Cycle 4-Speed Manual 2.31 litre F570 Unleaded Gas EM-191-F

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	900	0.0	0.0	.009	.99	.99	.009
2	2400	3.0	.7	.039	.76	.80	.052
3	2400	51.6	13.0	.079	1.70	1.77	.046
4	2400	107.9	27.0	.119	2.55	2.67	.047
5	2400	132.6	33.3	.163	2.99	2.60	.067
6	2400	146.6	36.8	.200	2.52	2.72	.079
7	900	0.0	0.0	.009	.99	.99	.009
8	4000	130.7	54.7	.313	3.81	4.13	.082
9	4000	117.3	49.1	.256	3.76	4.02	.068
10	4000	101.5	42.5	.200	2.99	3.13	.068
11	4000	55.9	23.2	.192	2.27	2.91	.063
12	4000	2.7	1.1	.085	1.95	1.59	.059
13	900	0.0	0.0	.009	.99	.99	.009

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	67	29	80	0.00	*	*	*	8.9
2	98	93	149	.06	1.50	2.69	15.18	8.9
3	30	50	686	1.09	.12	.90	8.93	8.9
4	70	73	1028	2.16	.20	.92	9.64	8.9
5	2720	36891	288	2.67	6.16	166.95	2.19	9.9
6	2898	40191	191	2.95	6.11	171.55	1.39	9.9
7	50	59	67	0.00	*	*	*	9.9
8	5669	44072	389	4.38	12.93	192.68	2.76	9.9
9	50	21	1116	3.93	.12	.10	8.70	9.9
10	30	27	999	3.90	.06	.12	6.63	9.8
11	15	22	610	1.86	.05	.13	6.09	9.8
12	11	22	219	.09	.99	1.73	27.93	9.8
13	19	29	68	0.00	*	*	*	9.8

CYCLE COMPOSITE BSHC = 4.016 GRAM/KW HR
BSCO* = 74.789 GRAM/KW HR
BSNO2*** 5.501 GRAM/KW HR
BSHC + BSNO2*** 9.517 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

TABLE B-14. 13-MODE FEDERAL DIESEL EMISSION CYCLE

[illegible] CHASSIS SIMULATED 13 MODE 6-19-79 TEST 2 FORD BLUE CAPRI
PROCO [illegible] LAM 71.52.2kw 4-Cycle 4-Speed Manual 2.31 litre F570 Unleaded Gas EM-191-F

MODE	ENGINE SPEED RPM	TORQUE N M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	900	0.0	0.0	.009	.99	.99	.009
2	2400	3.0	.7	.039	.76	.80	.052
3	2400	51.6	13.0	.079	1.70	1.78	.046
4	2400	107.9	27.0	.119	2.59	2.71	.046
5	2400	132.6	33.3	.166	2.98	2.65	.067
6	2400	146.6	36.8	.200	2.98	2.68	.081
7	900	0.0	0.0	.009	.99	.99	.009
8	4000	130.7	54.7	.313	3.82	4.13	.082
9	4000	117.4	49.1	.256	3.77	4.02	.068
10	4000	101.5	42.5	.200	2.92	3.12	.068
11	4000	55.9	23.2	.192	2.93	2.57	.058
12	4000	2.7	1.1	.085	1.47	1.56	.058
13	900	0.0	0.0	.009	.99	.95	.009

MODE	HC PPM	CO* PPM	NO** PPM	WEIGHTED KW	BSHC G/KW HR	BSCO* G/KW HR	BSNO2** G/KW HR	HUM. MILLI G/KG
1	80	23	80	0.00	*	*	*	9.9
2	97	28	150	.06	1.47	1.76	15.28	9.9
3	30	93	707	1.09	.12	.39	9.22	9.9
4	60	57	1131	2.16	.18	.33	10.83	9.9
5	2900	22328	378	2.67	5.55	102.80	2.66	8.7
6	2720	39293	290	2.95	5.75	165.26	2.00	8.7
7	95	59	80	0.00	*	*	*	8.7
8	9800	49130	939	4.38	10.55	193.16	3.12	8.7
9	50	27	1192	3.93	.12	.13	8.90	8.7
10	80	27	888	3.90	.09	.12	6.21	8.3
11	13	22	677	1.86	.09	.14	7.16	8.3
12	10	22	298	.09	.90	1.76	32.80	8.3
13	22	29	66	0.00	*	*	*	8.3

CYCLE COMPOSITE BSHC = 3.523 GRAM/KW HR
BSCO* = 71.956 GRAM/KW HR
BSNO2*** 5.950 GRAM/KW HR
BSHC + BSNO2*** 9.473 GRAM/KW HR

* CONVERTED TO WET BASIS
** CONVERTED TO WET BASIS AND CORRECTED TO 10.7 MILLIGRAMS WATER PER KG DRY AIR

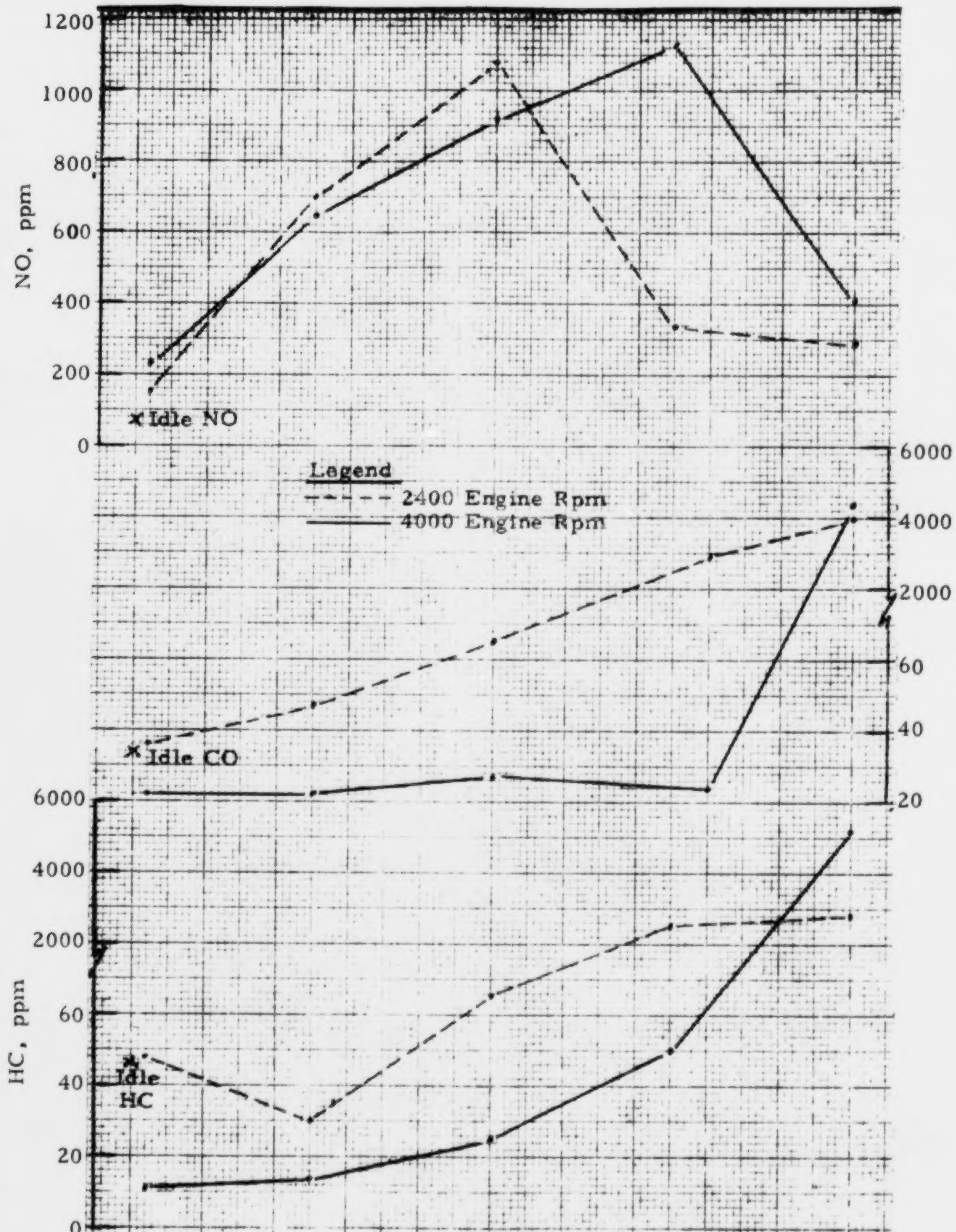

FIGURE B-5. GASEOUS EMISSIONS MAP OF CAPRI PROCO GASOLINE CAR

Table B-15. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2340-005 CHASSIS SIMULATED 13 MODE 3-MIN MODE 10-18-74 TEST 1 TEXACO TCCS IN
PLYMOUTH CRICKET 70 HP 4 CYL. 3-SPEED AUTO 141 CID DIESEL FUEL 2-D EMISSIONS

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO	MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	900	0,0	0,0	,014	,77	,78	,018	1	2672	1710	128	0,00	R	R	R	8,7
2	1800	0,0	0,0	,025	2,17	2,19	,012	2	3136	1085	40	0,00	R	R	R	8,7
3	1800	57,4	10,8	,064	2,42	2,49	,027	3	1296	71	253	,87	8,68	,95	5,54	8,7
4	1800	122,7	23,1	,104	2,97	3,07	,035	4	204	68	612	1,85	,79	,52	7,74	8,7
5	1800	190,3	35,9	,143	3,37	3,51	,042	5	91	61	918	2,87	,26	,34	8,57	8,7
6	0	0,0	0,0	,143	3,37	3,51	,042	6	0	0	0	0,00	I	I	I	8,7
7	940	0,0	0,0	,011	,77	,78	,015	7	55	10	133	0,00	R	R	R	8,5
8	3000	181,4	57,0	,213	4,79	5,01	,044	8	48	83	1072	4,56	,12	,42	8,97	8,5
9	3000	136,0	42,7	,170	4,43	4,60	,038	9	27	55	879	3,42	,08	,34	9,02	8,5
10	3000	90,7	28,5	,128	4,15	4,27	,031	10	36	52	631	2,28	,16	,45	9,01	8,5
11	3000	45,3	14,2	,085	3,84	3,92	,022	11	124	72	295	1,14	,99	1,14	7,73	8,5
12	3000	0,0	0,0	,042	3,50	3,55	,012	12	2016	868	67	0,00	R	R	R	8,2
13	940	0,0	0,0	,014	,76	,78	,018	13	1776	1415	111	0,00	R	R	R	8,2

CYCLE COMPOSITE BSHC = 3,037 GRAM/KW HR
BSCO+ = 2,533 GRAM/KW HR
BSNO2++= 8,781 GRAM/KW HR
BSHC + BSNO2++= 11,818 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

Table B-16. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2340-005 CHASSIS SIMULATED 13 MODE 3-MIN MODES 10-18-74 TEST 2 TEXACO TCCS IN
PLYMOUTH CRICKET 70HP 4 CYL. 3-SPEED AUTO 141 CID DIESEL FUEL 2-D EMISSIONS

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO	MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	900	0,0	0,0	,014	,77	,78	,018	1	2624	1288	73	0,00	R	R	R	8,5
2	1800	0,0	0,0	,025	2,16	2,19	,012	2	3200	1029	33	0,00	R	R	R	8,5
3	1800	57,4	10,8	,064	2,38	2,44	,027	3	1184	58	230	,87	7,79	,76	4,95	8,4
4	1800	122,7	23,1	,104	2,97	3,07	,035	4	311	55	555	1,85	1,20	,42	7,02	8,4
5	1800	190,3	35,9	,143	3,37	3,51	,042	5	131	59	833	2,87	,37	,33	7,77	8,2
6	0	0,0	0,0	,143	3,37	3,51	,042	6	0	0	0	0,00	I	I	I	8,2
7	990	0,0	0,0	,011	,76	,78	,015	7	76	10	126	0,00	R	R	R	8,2
8	3000	181,4	57,0	,218	4,79	5,01	,045	8	72	73	1190	4,56	,18	,37	9,54	8,2
9	3000	136,0	42,7	,170	4,43	4,60	,038	9	37	64	849	3,42	,12	,40	8,71	7,5
10	3000	90,7	28,5	,128	4,15	4,27	,031	10	52	55	619	2,28	,23	,48	8,77	7,5
11	3000	45,3	14,2	,085	3,84	3,93	,022	11	131	69	290	1,14	1,05	1,10	7,61	7,3
12	3000	0,0	0,0	,042	3,51	3,55	,012	12	2656	864	63	0,00	R	R	R	7,3
13	950	0,0	0,0	,013	,77	,78	,017	13	1968	1293	110	0,00	R	R	R	7,3

CYCLE COMPOSITE BSHC = 3,436 GRAM/KW HR
BSCO+ = 2,374 GRAM/KW HR
BSNO2++= 8,556 GRAM/KW HR
BSHC + BSNO2++= 11,991 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

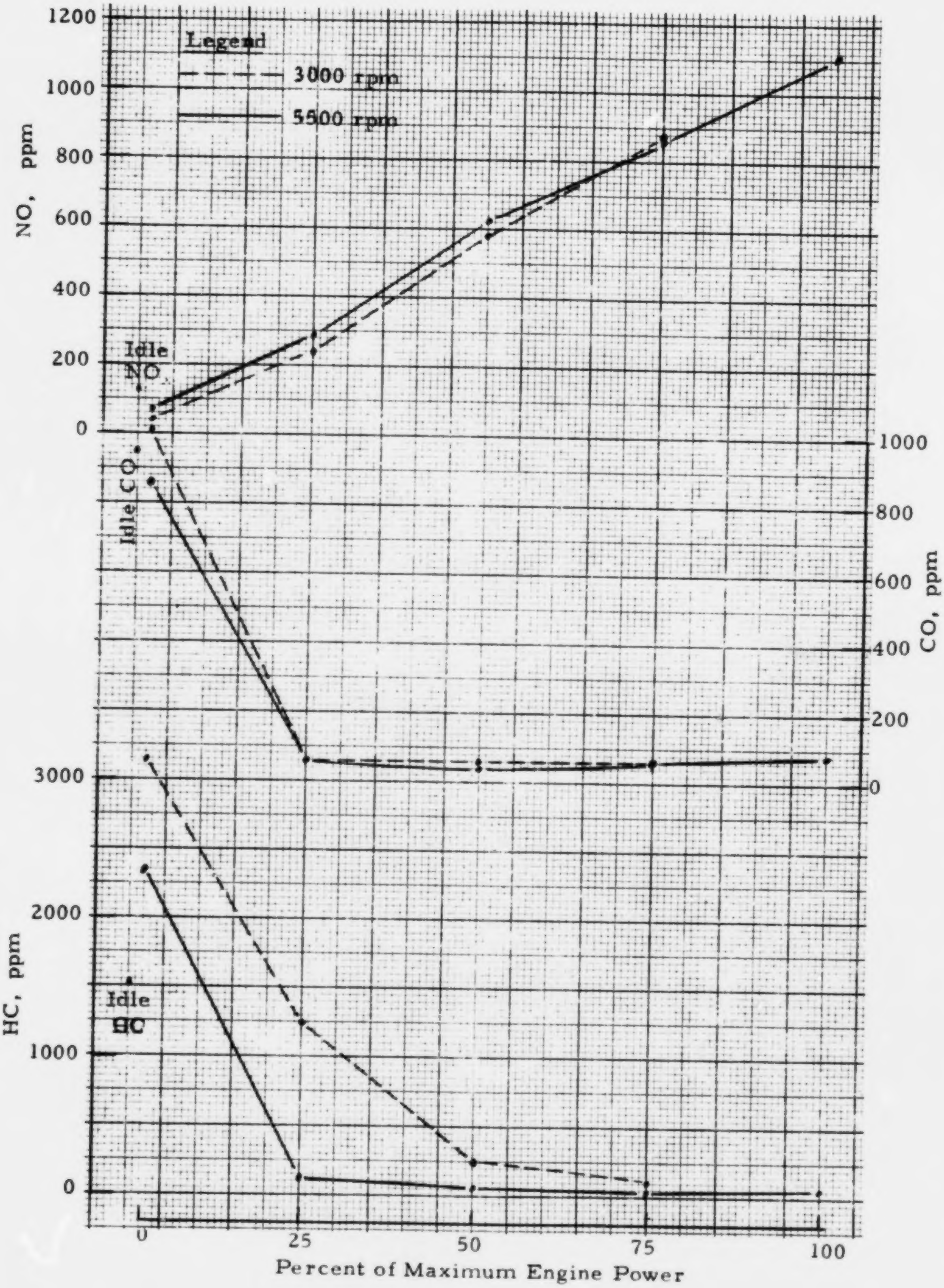

FIGURE B-6. GASEOUS EMISSIONS MAP OF TEXACO TCCS POWERED PLYMOUTH CRICKET CAR - DIESEL FUEL

Table B-17. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13 MODE 3-MIN MODE 10-21-74 TEST 1 TEXACO TCCS IN
PLYMOUTH CRICKET 70 HP 4CY 3-SPEED AUTO 141 CID UNLEADED 91 RON GASOLINE

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	900	0,0	0,0	,011	.77	,78	,019
2	1800	0,0	0,0	,023	2.18	2,20	,011
3	1800	45,5	8,6	,057	2.39	2,45	,024
4	1800	102,9	19,4	,091	2,81	2,90	,032
5	1800	163,0	30,7	,124	3.20	3,33	,039
6	0	0,0	0,0	,124	3.20	3,33	,039
7	900	0,0	0,0	,011	.77	,78	,019
8	3000	159,3	50,0	,185	4.69	4,83	,040
9	3000	119,4	37,5	,151	4.26	4,42	,035
10	3000	79,8	25,1	,117	4.17	4,28	,028
11	3000	39,9	12,5	,083	3.86	3,94	,022
12	3000	0,0	0,0	,049	3.69	3,69	,019
13	900	0,0	0,0	,011	.77	,78	,019

MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	600	11	98	0,00	R	R	R	10,3
2	2480	495	53	0,00	R	R	R	10,3
3	280	27	249	,69	2,33	,45	6,78	10,3
4	57	28	497	1,55	,25	,24	7,08	10,3
5	19	36	721	2,46	,06	,23	7,99	10,3
6	0	0	0	0,00	I	I	I	10,3
7	154	7	124	0,00	R	R	R	9,8
8	25	41	957	4,00	,07	,23	8,79	9,8
9	19	38	713	3,00	,07	,26	7,99	9,8
10	58	31	426	2,00	,29	,30	6,93	9,8
11	350	36	220	1,00	3,20	,65	6,58	10,1
12	4192	313	73	0,00	R	R	R	10,1
13	2000	474	110	0,00	R	R	R	9,4

CYCLE COMPOSITE BSHC = 4,028 GRAM/KW HR
BSCO+ = 1,093 GRAM/KW HR
BSNO2++= 8,035 GRAM/KW HR
BSHC + BSNO2++= 12,063 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

Table B-18. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2390-005 CHASSIS SIMULATED 13 MODE 3-MIN MODE 10-21-74 TEST 2 TEXACO TCCS IN
PLYMOUTH CRICKET 70 HP 4 CYL 3-SPEED AUTO 141 CID UNLEADED 91 RON GASOLINE

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	900	0,0	0,0	,011	.77	,78	,019
2	1800	0,0	0,0	,023	2.17	2.20	,011
3	1800	45,5	8,6	,057	2.39	2,45	,024
4	1800	102,9	19,4	,091	2,81	2,90	,032
5	1800	163,0	30,7	,124	3.20	3,32	,039
6	0	0,0	0,0	,124	3.20	3,32	,039
7	900	0,0	0,0	,011	.77	,78	,019
8	3000	159,3	50,0	,185	4.63	4,82	,040
9	3000	119,4	37,5	,151	4.26	4,41	,036
10	3000	79,8	25,1	,117	4.16	4,28	,028
11	3000	39,9	12,5	,083	3.85	3,94	,022
12	3000	0,0	0,0	,049	3.63	3,68	,019
13	900	0,0	0,0	,011	.77	,78	,019

MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	1440	346	108	0,00	R	R	R	10,3
2	3360	638	42	0,00	R	R	R	10,3
3	270	15	231	,69	2,24	,25	6,27	10,3
4	50	28	461	1,55	,22	,24	6,56	11,3
5	19	34	775	2,46	,06	,21	7,99	11,3
6	0	0	0	0,00	I	I	I	11,3
7	145	7	106	0,00	R	R	R	11,3
8	17	37	924	4,00	,05	,21	8,47	11,3
9	17	35	660	3,00	,06	,24	7,39	10,3
10	65	29	406	2,00	,32	,29	6,60	10,3
11	440	36	232	1,00	4,02	,65	6,93	10,3
12	4928	304	63	0,00	R	R	R	10,3
13	1808	435	98	0,00	R	R	R	10,3

CYCLE COMPOSITE BSHC = 4,872 GRAM/KW HR
BSCO+ = 1,223 GRAM/KW HR
BSNO2++= 7,778 GRAM/KW HR
BSHC + BSNO2++= 12,650 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

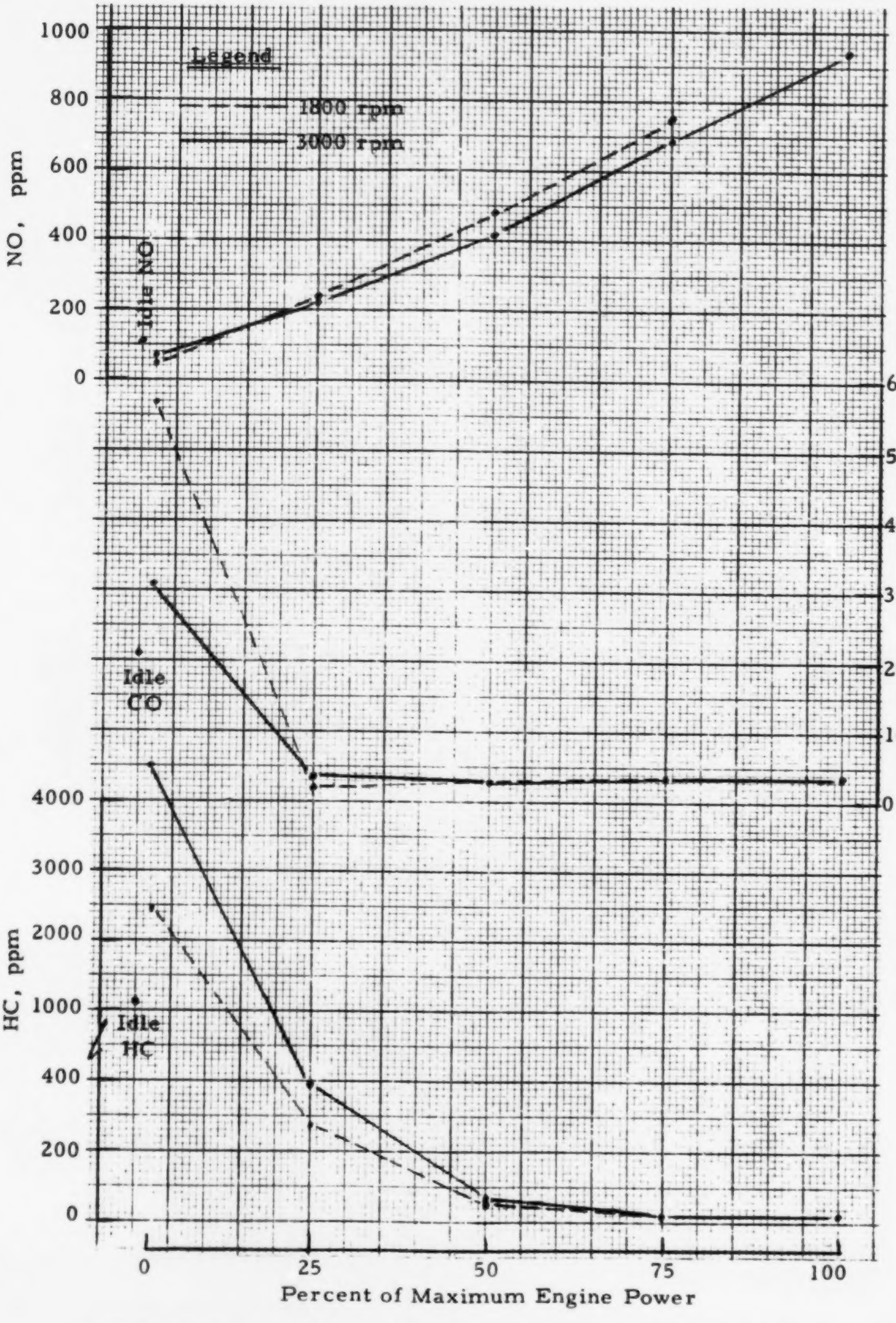

FIGURE B-7. GASEOUS EMISSIONS MAP OF TEXACO TCCS POWERED PLYMOUTH CRICKET CAR - GASOLINE

Table B-19. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2340-005 CHASSIS SIMULATED 13 MODE 3-MIN MODE 11-6-74 TEST 1 HONDA CVCC CIVIC
63 HP 4 CYL 4 SPEED MAN 1,488 LITER 74 X 86.5 MM BXS UNLEADED 91 RON GASOLINE

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	1000	0,0	0,0	,013	.21	,23	,060
2	3000	0,0	0,0	,031	.54	,57	,057
3	3000	24,9	7,8	,062	.99	1,05	,063
4	3000	50,1	15,7	,082	1,33	1,41	,062
5	3000	75,0	23,6	,108	1,60	1,71	,067
6	3000	49,9	31,4	,134	1,79	1,92	,075
7	1000	0,0	0,0	,013	.21	,23	,060
8	5500	81,6	47,0	,233	2,78	3,01	,084
9	5500	61,2	35,3	,193	2,39	2,59	,080
10	5500	40,8	23,5	,153	2,09	2,25	,073
11	5500	20,5	11,8	,113	1,95	2,07	,058
12	5500	0,0	0,0	,073	1,11	1,18	,066
13	1000	0,0	0,0	,013	.21	,23	,060

MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	636	2612	86	0,00	R	R	R	9,1
2	21	804	106	0,00	R	R	R	9,1
3	19	811	536	,63	,07	6,31	6,85	9,1
4	20	978	1074	1,26	,05	5,09	9,19	8,2
5	500	3778	2863	1,89	1,06	15,91	19,80	8,2
6	1280	17013	2086	2,51	2,28	60,33	12,15	7,6
7	516	2618	166	0,00	R	R	R	7,6
8	1872	28431	801	3,76	3,49	105,60	4,89	7,3
9	1504	25449	461	2,82	3,21	108,25	3,22	7,3
10	100	4599	962	1,88	,28	25,51	8,77	6,3
11	16	427	676	,94	,08	4,34	11,29	6,3
12	15	300	209	0,00	R	R	R	5,8
13	280	2451	82	0,00	R	R	R	5,8

CYCLE COMPOSITE BSHC = 1,996 GRAM/KW HR
BSCO+ = 61,006 GRAM/KW HR
BSNO2++= 8,996 GRAM/KW HR
BSHC + BSNO2++= 10,992 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

Table B-20. 13-MODE FEDERAL DIESEL EMISSION CYCLE

11-2340-005 CHASSIS SIMULATED 13 MODE 3 MIN MODE 11-6-74 TEST 2 HONDA CVCC CIVIC
63 HP 4 CYL 4 SPEED MAN 1,488 LITER 74 X 86.5 MM BXS UNLEADED 91 RON GASOLINE

MODE	ENGINE SPEED RPM	TORQUE N X M	POWER KW	FUEL FLOW KG/MIN	AIR FLOW KG/MIN	EXHAUST FLOW KG/MIN	FUEL AIR RATIO
1	1000	0,0	0,0	,013	.21	,23	,060
2	3000	0,0	0,0	,031	.55	.58	,057
3	3000	24,9	7,8	,062	.99	1,05	,063
4	3000	50,1	15,7	,082	1,34	1,43	,061
5	3000	75,0	23,6	,108	1,61	1,71	,067
6	3000	49,9	31,4	,134	1,79	1,92	,075
7	1000	0,0	0,0	,013	.21	,23	,060
8	5500	81,6	47,0	,233	2,77	3,00	,084
9	5500	61,2	35,3	,193	2,35	2,55	,082
10	5500	40,8	23,5	,153	2,06	2,21	,074
11	5500	20,5	11,8	,113	1,90	2,02	,059
12	5500	0,0	0,0	,073	1,09	1,16	,067
13	1000	0,0	0,0	,013	.21	,23	,060

MODE	HC PPM	CO+ PPM	NO++ PPM	WEIGHTED KW	BSHC G/KW HR	BSCO+ G/KW HR	BSNO2++ G/KW HR	HUM, MILLI G/KG
1	620	2970	84	0,00	R	R	R	7,1
2	19	791	90	0,00	R	R	R	7,1
3	21	829	506	,63	,08	6,44	6,46	7,1
4	26	1087	1094	1,26	,07	5,71	9,44	7,1
5	520	4128	2856	1,89	1,10	17,41	19,78	7,5
6	1440	14652	2218	2,51	2,57	52,09	12,95	7,5
7	588	2968	121	0,00	R	R	R	7,5
8	1872	28897	704	3,76	3,48	106,93	4,28	7,5
9	1472	26114	468	2,82	3,09	109,28	3,22	7,5
10	95	4579	931	1,88	,26	24,97	8,34	7,3
11	10	439	584	,94	,05	4,36	9,52	7,3
12	9	355	219	0,00	R	R	R	7,3
13	280	2183	96	0,00	R	R	R	7,3

CYCLE COMPOSITE BSHC = 2,021 GRAM/KW HR
BSCO+ = 60,402 GRAM/KW HR
BSNO2++= 8,817 GRAM/KW HR
BSHC + BSNO2++= 10,838 GRAM/KW HR

+ CONVERTED TO WET BASIS
++ CONVERTED TO WET BASIS AND CORRECTED TO 10,7 MILLIGRAMS WATER PER KG DRY AIR

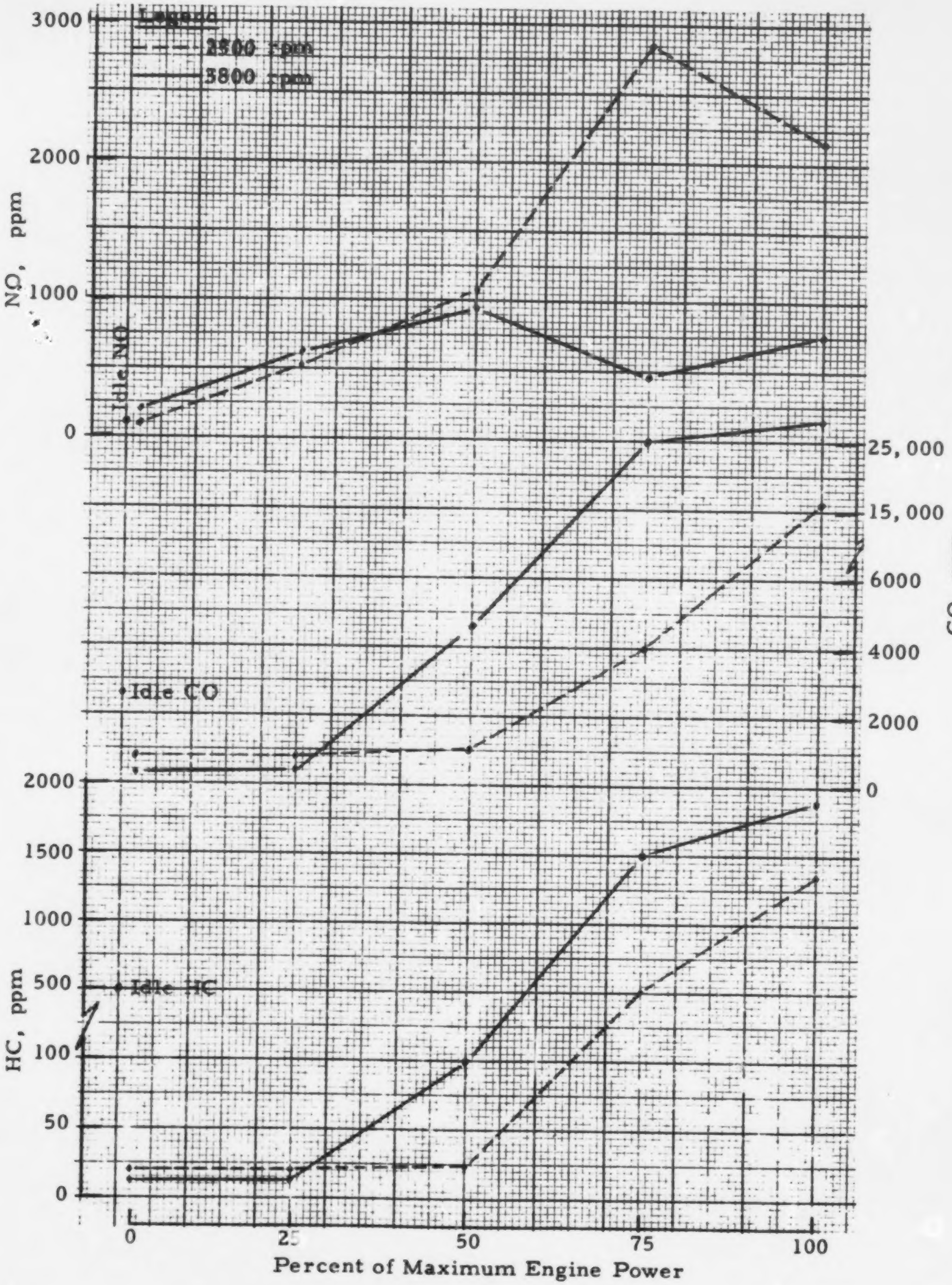

FIGURE B-8. GASEOUS EMISSIONS MAP OF HONDA CVCC CIVIC CAR

APPENDIX C

ODOR RATINGS BY EPA Q/I METHOD

TABLE C-1. ODOR SUMMARY--NISSAN-DATSUN EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1800 rpm	0	1/8/74 W	3.1	1.1	0.9	0.7	0.6
		1/10/74 S	3.1	1.1	0.9	0.7	0.6
1800 rpm	1/2	1/8/74 W	2.8	1.0	0.9	0.6	0.3
24 mph		1/10/74 S	3.0	1.0	0.9	0.8	0.5
1800 rpm	Full	1/8/74 W	3.8	1.1	1.0	0.9	0.7
24 mph		1/10/74 S	3.7	1.1	1.0	0.9	0.7
3000 rpm	0	1/8/74 W	2.4	1.0	0.8	0.5	0.3
		1/10/74 S	2.1	1.0	0.8	0.6	0.2
3000 rpm	1/2	1/8/74 W	3.7	1.3	1.0	0.7	0.7
40 mph		1/10/74 S	3.1	1.1	1.0	0.9	0.4
3000 rpm	Full	1/8/74 W	4.8	1.7	1.2	0.9	0.9
40 mph		1/10/74 S	3.9	1.1	1.0	0.8	0.8
Idle		1/8/74 W	2.9	1.0	0.9	0.5	0.4
		1/10/74 S	2.7	1.0	0.8	0.7	0.5
Idle-Acceleration		1/8/74 W	3.5	1.1	1.0	0.8	0.7
		1/10/74 S	3.8	1.2	1.0	0.9	0.7
Acceleration		1/8/74 W	5.6	1.9	1.4	0.9	1.4
		1/10/74 S	5.0	1.7	1.2	0.9	1.1
Deceleration		1/8/74 W	4.9	1.7	1.2	0.9	1.2
		1/10/74 S	5.1	1.6	1.2	0.9	1.1

W - Winter Switch
S - Summer Switch

TABLE C-2. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Nissan - Datsun Diesel - Winter Switch
Date: January 8, 1974 Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter -0	2.0	1.0	0.8	0.3	0.3
15.		3.3	1.1	1.0	1.0	0.5
18.		3.9	1.1	1.0	0.8	0.9
		3.1	1.1	0.9	0.7	0.6
6.	Inter - 50	2.8	1.0	1.0	0.4	0.4
9.		2.3	1.0	0.8	0.8	0.1
11.		3.3	1.0	1.0	0.5	0.5
		2.8	1.0	0.9	0.6	0.3
3.	Inter - 100	4.0	1.1	1.0	0.9	1.0
14.		3.5	1.1	1.0	0.9	0.4
16.		3.8	1.1	1.0	1.0	0.6
		3.8	1.1	1.0	0.9	0.7
5.	High - 0	2.4	1.0	0.8	0.6	0.3
10.		2.4	1.0	0.6	0.6	0.3
17.		2.3	0.9	0.9	0.4	0.4
		2.4	1.0	0.8	0.5	0.3
4.	High - 50	2.4	1.0	1.0	0.3	0.3
13.		4.3	1.4	1.0	0.9	0.9
19.		4.4	1.5	1.1	0.8	0.8
		3.7	1.3	1.0	0.7	0.7
1.	High - 100	4.5	1.6	1.3	0.6	0.9
7.		4.6	1.6	1.1	1.0	0.9
21.		5.2	1.9	1.1	1.0	1.0
		4.8	1.7	1.2	0.9	0.9
8.	Idle	2.6	1.0	0.8	0.8	0.1
12.		2.5	1.0	0.9	0.4	0.4
20.		3.5	1.1	1.0	0.4	0.8
		2.9	1.0	0.9	0.5	0.4
23.	Idle-Acceleration	3.6	1.0	0.9	1.0	0.7
25.		3.3	1.0	1.0	0.7	0.7
30.		3.3	1.1	1.0	0.9	0.4
33.		3.7	1.1	1.0	0.7	0.9
		3.5	1.1	1.0	0.8	0.7
24.	Acceleration	5.9	2.0	1.4	1.0	1.3
27.		6.0	2.0	1.4	1.0	1.4
28.		5.4	1.7	1.4	0.9	1.4
31.		5.1	1.7	1.3	0.7	1.3
		5.6	1.9	1.4	0.9	1.4
22.	Deceleration	5.0	1.7	1.1	0.9	1.1
26.		5.1	1.6	1.4	0.7	1.4
29.		4.6	1.4	1.0	1.0	1.1
32.		5.0	1.9	1.1	1.0	1.0
		4.9	1.7	1.2	0.9	1.2

TABLE C-3. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Nissan - Datsun Diesel - Summer Switch
Date: January 10, 1974 Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
6.	Inter - 0	4.0	1.3	0.9	1.0	0.9
14.		3.4	1.1	1.0	0.6	0.8
16.		2.0	1.0	0.8	0.5	0
		3.1	1.1	0.9	0.7	0.6
5.	Inter - 50	2.6	1.0	0.8	0.6	0.3
10.		3.2	1.0	0.9	0.9	0.5
21.		3.3	1.0	1.0	0.8	0.6
		3.0	1.0	0.9	0.8	0.5
4.	Inter - 100	3.6	1.1	1.0	0.9	0.6
11.		4.0	1.3	1.0	0.9	0.9
19.		3.4	1.0	1.0	0.9	0.6
		3.7	1.1	1.0	0.9	0.7
2.	High - 0	2.1	0.9	0.6	0.8	0.3
12.		1.9	1.0	0.8	0.5	0.1
20.		2.3	1.0	0.9	0.4	0.1
		2.1	1.0	0.8	0.6	0.2
8.	High - 50	2.7	1.0	0.9	0.8	0.1
13.		3.3	1.1	1.0	0.8	0.5
17.		3.4	1.1	1.0	1.0	0.5
		3.1	1.1	1.0	0.9	0.4
1.	High - 100	3.3	1.0	1.0	0.6	0.6
7.		4.0	1.3	1.0	0.9	0.8
15.		4.3	1.1	1.0	1.0	1.0
		3.9	1.1	1.0	0.8	0.8
3.	Idle	2.3	0.9	0.6	0.6	0.3
9.		2.9	1.0	0.9	0.5	0.8
18.		2.9	1.0	0.9	0.9	0.4
		2.7	1.0	0.8	0.7	0.5
23.	Idle-Acceleration	3.6	1.1	1.0	1.0	0.6
26.		4.3	1.3	1.1	0.9	0.9
29.		3.0	1.0	0.9	0.9	0.4
31.		4.4	1.3	1.0	0.9	0.9
		3.8	1.2	1.0	0.9	0.7
22.	Acceleration	5.0	1.6	1.3	0.9	1.0
24.		5.0	1.6	1.1	0.9	1.1
28.		5.1	1.7	1.3	0.9	1.1
33.		5.0	1.7	1.0	1.0	1.0
		5.0	1.7	1.2	0.9	1.1
25.	Deceleration	5.3	1.7	1.4	0.9	1.1
27.		5.0	1.7	1.1	0.9	1.0
30.		5.1	1.4	1.3	0.9	1.1
32.		5.0	1.7	1.0	1.0	1.0
		5.1	1.6	1.2	0.9	1.1

TABLE C-4. ODOR SUMMARY--MERCEDES 220D EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1830 rpm	0	1/15/74	2.7	1.0	0.9	0.4	0.5
		1/17/74	2.5	1.0	0.9	0.6	0.2
		Average	2.6	1.0	0.9	0.5	0.4
1830 rpm	1/2	1/15/74	2.5	1.0	0.9	0.5	0.4
33 mph		1/17/74	2.7	1.0	0.9	0.7	0.2
		Average	2.6	1.0	0.9	0.6	0.3
1830 rpm	Full	1/15/74	3.5	1.1	0.9	0.8	0.8
33 mph		1/17/74	3.3	1.0	0.9	0.8	0.7
		Average	3.4	1.1	0.9	0.8	0.8
3050 rpm	0	1/15/74	2.3	1.0	0.9	0.4	0.4
		1/17/74	2.8	1.0	0.9	0.6	0.4
		Average	2.6	1.0	0.9	0.5	0.4
3050 rpm	1/2	1/15/74	3.2	1.1	0.9	0.6	0.7
56 mph		1/17/74	2.9	1.0	0.9	0.6	0.5
		Average	3.1	1.1	0.9	0.6	0.6
3050 rpm	Full	1/15/74	3.7	1.1	1.0	0.7	0.7
56 mph		1/17/74	4.1	1.2	1.0	0.9	1.0
		Average	3.9	1.2	1.0	0.8	0.9
Idle		1/15/74	3.1	1.0	0.8	0.8	0.6
		1/17/74	3.1	1.0	0.9	0.7	0.5
		Average	3.1	1.0	0.8	0.8	0.6
Idle-Acceleration		1/15/74	3.4	1.2	1.0	0.8	0.8
		1/17/74	4.5	1.5	1.0	0.8	1.0
		Average	4.0	1.4	1.0	0.8	0.9
Acceleration		1/15/74	3.5	1.1	1.0	0.8	0.9
		1/17/74	3.2	1.0	1.0	0.6	0.8
		Average	3.4	1.1	1.0	0.7	0.9
Deceleration		1/15/74	3.5	1.1	1.0	0.9	0.7
		1/17/74	3.8	1.1	1.0	0.9	0.8
		Average	3.7	1.1	1.0	0.9	0.8

TABLE C-5. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Mercedes 220D
Date: January 15, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	2.3	0.9	0.9	0.3	0.4
10.		2.8	1.0	1.0	0.4	0.6
20.		3.0	1.0	0.9	0.5	0.4
		2.7	1.0	0.9	0.4	0.5
1.	Inter - 50	2.1	0.9	0.8	0.3	0.4
8.		2.3	1.0	0.9	0.5	0.3
18.		3.0	1.0	0.9	0.6	0.6
		2.5	1.0	0.9	0.5	0.4
9.	Inter - 100	4.0	1.3	1.1	0.6	1.0
11.		3.4	1.0	1.0	0.9	0.6
15.		3.2	1.0	0.6	0.8	0.9
		3.5	1.1	0.9	0.8	0.8
6.	High - 0	2.4	1.0	0.9	0.4	0.3
14.		2.2	0.9	0.9	0.5	0.4
19.		2.4	1.0	0.9	0.3	0.5
		2.3	1.0	0.9	0.4	0.4
5.	High - 50	3.4	1.1	0.9	0.5	0.9
7.		3.6	1.1	1.0	0.9	0.9
16.		2.6	1.0	0.8	0.4	0.3
		3.2	1.1	0.9	0.6	0.7
3.	High - 100	3.7	1.1	1.0	0.6	0.4
13.		3.4	1.0	1.0	0.6	0.9
21.		4.1	1.3	1.0	1.0	0.9
		3.7	1.1	1.0	0.7	0.7
4.	Idle	3.1	1.0	0.8	0.8	0.5
12.		2.9	1.0	0.6	0.8	0.5
17.		3.4	1.0	1.0	0.9	0.9
		3.1	1.0	0.8	0.8	0.6
22.	Idle-Acceleration	3.4	1.3	1.0	0.7	0.9
24.		4.2	1.3	1.0	0.9	1.0
27.		3.1	1.0	0.9	1.0	0.7
31.		3.0	1.0	1.0	0.7	0.7
		3.4	1.2	1.0	0.8	0.8
26.	Acceleration	3.3	1.0	1.0	0.6	0.9
29.		3.5	1.1	1.0	0.9	0.9
30.		3.3	1.1	1.0	0.7	0.7
32.		3.8	1.1	1.0	0.9	1.0
		3.5	1.1	1.0	0.8	0.9
23.	Deceleration	3.3	1.0	1.0	0.6	0.7
25.		3.0	1.0	1.0	0.9	0.3
28.		4.1	1.3	1.0	1.0	0.9
33.		3.6	1.0	1.0	1.0	0.7
		3.5	1.1	1.0	0.9	0.7

TABLE C-6. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Mercedes 220D
Date: January 17, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
4.	Inter - 0	2.4	1.0	0.8	0.8	0.1
10.		2.7	1.1	0.9	0.5	0.4
12.		2.4	1.0	0.9	0.5	0.1
		2.5	1.0	0.9	0.6	0.2
2.	Inter - 50	3.3	1.0	1.0	0.9	0.4
8.		2.4	1.0	0.9	0.6	0.1
11.		2.4	1.0	0.9	0.6	0.1
		2.7	1.0	0.9	0.7	0.2
9.	Inter - 100	3.8	1.0	1.0	0.9	0.9
17.		2.8	1.0	0.8	1.0	0.3
21.		3.3	1.0	1.0	0.6	0.8
		3.3	1.0	0.9	0.8	0.7
3.	High - 0	3.4	1.0	1.0	0.9	0.5
6.		2.6	1.0	0.7	0.5	0.3
20.		2.3	1.0	0.9	0.4	0.3
		2.8	1.0	0.9	0.6	0.4
7.	High - 50	3.7	1.1	1.0	0.8	0.9
15.		2.7	1.0	1.0	0.5	0.4
16.		2.3	1.0	0.8	0.6	0.1
		2.9	1.0	0.9	0.6	0.5
5.	High - 100	4.2	1.3	1.0	0.9	1.0
13.		3.9	1.1	1.0	0.9	0.9
19.		4.2	1.1	1.0	0.9	1.0
		4.1	1.2	1.0	0.9	1.0
1.	Idle	2.6	1.0	0.9	0.4	0.4
14.		3.2	1.0	1.0	0.8	0.4
18.		3.4	1.1	0.9	0.9	0.8
		3.1	1.0	0.9	0.7	0.5
24.	Idle-Acceleration	4.4	1.4	1.0	0.7	1.0
28.		3.6	1.1	1.0	0.6	0.7
31.		5.1	1.7	1.0	1.0	1.0
33.		4.8	1.6	1.0	1.0	1.1
		4.5	1.5	1.0	0.8	1.0
23.	Acceleration	2.8	1.0	1.0	0.1	0.7
25.		3.4	1.0	1.0	0.4	1.0
26.		3.4	1.0	1.0	0.7	0.6
29.		3.3	1.0	1.0	0.7	0.9
		3.2	1.0	1.0	0.6	0.8
22.	Deceleration	3.9	1.1	1.0	0.9	0.9
27.		3.8	1.1	1.0	0.7	0.7
30.		3.3	1.0	1.0	1.0	0.6
32.		4.1	1.1	1.0	1.0	1.0
		3.8	1.1	1.0	0.9	0.8

TABLE C-7. ODOR SUMMARY--PEUGEOT 504D EVALUATION
100:1 Dilution

			"D"	"B"	"O"	"A"	"P"
Condition	Load	Date	Composite	Burnt	Oily	Aromatic	Pungent
1800 rpm	0	3/5/74	6.2	2.0	1.7	0.9	1.6
		3/7/74	5.7	1.8	1.5	1.1	1.2
		Average	6.0	1.9	1.6	1.0	1.4
1800 rpm 32 mph	1/2	3/5/74	4.4	1.5	1.1	0.9	0.9
		3/7/74	3.7	1.1	1.0	1.0	0.6
		Average	4.1	1.3	1.1	1.0	0.8
1800 rpm 32 mph	Full	3/5/74	4.7	1.5	1.0	1.0	0.9
		3/7/74	4.6	1.4	1.1	1.0	0.9
		Average	4.7	1.5	1.1	1.0	0.9
3000 rpm	0	3/5/74	6.3	1.9	1.8	1.0	1.5
		3/7/74	5.7	1.9	1.6	0.9	1.2
		Average	6.0	1.9	1.7	1.0	1.4
3000 rpm 56 mph	1/2	3/5/74	4.9	1.5	1.1	0.9	1.1
		3/7/74	4.4	1.4	1.1	0.9	0.9
		Average	4.7	1.5	1.1	0.9	1.0
3000 rpm 56 mph	Full	3/5/74	5.9	1.9	1.6	1.0	1.3
		3/7/74	5.2	1.7	1.2	1.1	1.1
		Average	5.6	1.8	1.4	1.1	1.2
Idle		3/5/74	4.8	1.5	1.2	0.9	1.1
		3/7/74	4.7	1.5	1.2	1.0	0.9
		Average	4.8	1.5	1.2	1.0	1.0
Idle-Acceleration		3/5/74	5.3	1.9	1.3	1.0	1.2
		3/7/74	5.8	1.9	1.5	1.0	1.4
		Average	5.6	1.9	1.4	1.0	1.3
Acceleration		3/5/74	6.1	2.0	1.7	1.0	1.5
		3/7/74	5.8	1.9	1.5	1.0	1.3
		Average	6.0	2.0	1.6	1.0	1.4
Deceleration		3/5/74	5.7	1.8	1.6	1.0	1.3
		3/7/74	5.2	1.6	1.2	1.0	1.1
		Average	5.5	1.7	1.4	1.0	1.2

TABLE C-8. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Peugeot 504D
Date: March 5, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	6.2	1.9	1.8	0.8	1.6
10.		6.1	2.0	1.8	0.9	1.6
20.		6.3	2.0	1.6	1.0	1.6
		6.2	2.0	1.7	0.9	1.6
1.	Inter - 50	4.9	1.8	1.1	0.9	1.1
8.		4.3	1.3	1.1	1.0	0.8
18.		4.1	1.3	1.1	0.9	0.7
		4.4	1.5	1.1	0.9	0.9
9.	Inter - 100	5.0	1.6	1.0	1.0	1.0
11.		5.2	1.7	1.2	0.9	1.1
15.		3.8	1.2	0.9	1.0	0.7
		4.7	1.5	1.0	1.0	0.9
6.	High - 0	6.3	2.0	2.0	1.0	1.6
14.		6.6	2.0	1.6	1.2	1.6
19.		6.0	1.8	1.8	0.9	1.4
		6.3	1.9	1.8	1.0	1.5
5.	High - 50	4.8	1.4	1.1	0.9	1.1
7.		4.8	1.4	1.0	0.9	1.0
16.		5.0	1.6	1.2	0.8	1.2
		4.9	1.5	1.1	0.9	1.1
3.	High - 100	5.8	2.0	1.7	0.9	1.2
13.		5.6	1.8	1.3	1.0	1.2
21.		6.2	2.0	1.7	1.1	1.4
		5.9	1.9	1.6	1.0	1.3
4.	Idle	4.3	1.2	1.0	1.0	1.0
12.		4.4	1.4	1.1	0.9	1.1
17.		5.7	1.9	1.6	0.9	1.3
		4.8	1.5	1.2	0.9	1.1
24.	Idle-Acceleration	5.1	1.9	1.1	1.0	1.0
28.		5.1	1.8	1.4	0.9	1.1
31.		5.3	1.9	1.3	1.0	1.3
33.		5.5	1.9	1.3	0.9	1.3
		5.3	1.9	1.3	1.0	1.2
23.	Acceleration	6.8	1.8	1.9	1.3	1.8
25.		6.1	2.0	1.6	1.0	1.4
26.		5.8	2.0	1.5	0.9	1.3
29.		5.8	2.0	1.6	0.9	1.3
		6.1	2.0	1.7	1.0	1.5
22.	Deceleration	5.5	1.9	1.4	1.0	1.1
27.		6.1	1.9	1.8	1.0	1.4
30.		5.1	1.6	1.3	1.0	1.1
32.		5.9	1.9	1.8	0.9	1.4
		5.7	1.8	1.6	1.0	1.3

TABLE C-9. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Peugeot 504D
Date: March 7, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
3.	Inter - 0	5.3	1.6	1.1	1.2	1.1
19.		5.9	1.9	1.6	1.2	1.2
21.		6.0	2.0	1.7	0.9	1.3
		5.7	1.8	1.5	1.1	1.2
8.	Inter - 50	4.0	1.2	1.1	1.0	0.8
11.		3.7	1.0	1.0	1.0	0.6
17.		3.4	1.0	1.0	1.0	0.4
		3.7	1.1	1.0	1.0	0.6
1.	Inter - 100	4.5	1.4	1.2	0.9	0.9
10.		4.6	1.4	1.2	1.0	0.9
14.		4.6	1.4	1.0	1.0	0.9
		4.6	1.4	1.1	1.0	0.9
5.	High - 0	5.8	1.9	1.9	0.7	1.4
7.		5.9	2.0	1.6	1.0	1.2
9.		5.3	1.9	1.3	1.0	1.0
		5.7	1.9	1.6	0.9	1.2
2.	High - 50	4.2	1.4	1.1	0.9	0.7
4.		5.0	1.7	1.2	0.9	1.1
15.		4.1	1.1	1.0	1.0	0.9
		4.4	1.4	1.1	0.9	0.9
6.	High - 100	5.4	1.8	1.1	1.3	1.1
12.		5.1	1.4	1.3	0.9	1.3
20.		5.1	1.8	1.2	1.0	0.9
		5.2	1.7	1.2	1.1	1.1
13.	Idle	5.2	1.7	1.4	0.9	1.1
16.		4.4	1.3	1.1	1.1	0.8
18.		4.4	1.4	1.0	1.0	0.9
		4.7	1.5	1.2	1.0	0.9
23.	Idle-Acceleration	5.8	1.6	1.5	1.0	1.4
26.		6.0	2.0	1.5	1.1	1.4
29.		6.0	1.9	1.6	1.0	1.5
32.		5.4	1.9	1.3	1.0	1.3
		5.8	1.9	1.5	1.0	1.4
22.	Acceleration	5.4	1.6	1.3	1.1	1.1
25.		5.6	1.9	1.5	0.9	1.1
27.		6.4	2.0	1.6	1.1	1.5
30.		5.6	1.9	1.4	0.9	1.3
		5.8	1.9	1.5	1.0	1.3
24.	Deceleration	4.9	1.4	1.1	0.9	1.1
28.		5.8	1.9	1.4	1.0	1.3
31.		5.0	1.6	1.1	1.0	1.0
33.		5.0	1.5	1.1	0.9	1.1
		5.2	1.6	1.2	1.0	1.1

TABLE C-10. ODOR SUMMARY--OPEL REKORD EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2300 rpm	0	3/19/74	3.5	1.2	1.0	0.7	0.6
		3/21/74	3.5	1.1	0.9	0.9	0.6
		Average	3.5	1.2	1.0	0.8	0.6
2300 rpm	1/2	3/19/74	4.3	1.4	1.0	0.9	1.0
22 mph		3/21/74	4.0	1.3	1.0	0.9	0.9
		Average	4.2	1.4	1.0	0.9	1.0
2300 rpm	Full	3/19/74	3.6	1.2	1.0	0.8	0.6
22 mph		3/21/74	3.8	1.2	1.0	0.8	0.8
		Average	3.7	1.2	1.0	0.8	0.7
3250 rpm	0	3/19/74	3.3	1.1	1.0	0.7	0.6
		3/21/74	3.3	1.1	1.0	0.8	0.5
		Average	3.3	1.1	1.0	0.8	0.6
3250 rpm	1/2	3/19/74	4.8	1.6	1.1	1.0	1.2
56 mph		3/21/74	4.1	1.3	1.0	1.0	0.9
		Average	4.5	1.5	1.1	1.0	1.1
3250 rpm	Full	3/19/74	3.9	1.3	1.0	0.9	0.8
56 mph		3/21/74	4.1	1.2	1.0	0.9	0.9
		Average	4.0	1.3	1.0	0.9	0.9
Idle		3/19/74	3.5	1.1	1.0	0.7	0.6
		3/21/74	3.0	1.0	1.0	0.8	0.3
		Average	3.3	1.1	1.0	0.8	0.5
Idle-Acceleration		3/19/74	5.2	1.8	1.3	0.7	1.4
		3/21/74	4.8	1.7	1.1	1.0	1.3
		Average	5.0	1.8	1.2	0.9	1.4
Acceleration		3/19/74	3.8	1.2	1.0	0.9	0.9
		3/21/74	3.7	1.1	1.0	0.9	0.8
		Average	3.8	1.2	1.0	0.9	0.9
Deceleration		3/19/74	3.4	1.0	0.9	0.8	0.7
		3/21/74	3.3	1.1	1.0	0.7	0.7
		Average	3.4	1.1	1.0	0.8	0.7

TABLE C-11. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Opel Rekord
Date: March 19, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	3.6	1.1	1.0	0.8	0.8
10.		3.8	1.4	1.0	0.8	0.6
20.		3.0	1.1	1.0	0.5	0.5
		3.5	1.2	1.0	0.7	0.6
1.	Inter - 50	3.9	1.1	1.0	1.0	0.8
8.		4.1	1.4	0.9	0.8	1.3
18.		4.9	1.8	1.1	1.0	1.0
		4.3	1.4	1.0	0.9	1.0
9.	Inter - 100	4.0	1.1	1.0	1.0	0.8
11.		3.3	1.1	1.0	0.8	0.5
15.		3.4	1.3	1.0	0.5	0.5
		3.6	1.2	1.0	0.8	0.6
6.	High - 0	3.3	1.1	1.0	0.6	0.6
14.		3.0	1.0	0.9	0.5	0.5
19.		3.7	1.3	1.0	0.9	0.6
		3.3	1.1	1.0	0.7	0.6
5.	High - 50	4.2	1.4	1.0	0.9	1.1
7.		4.8	1.5	1.1	1.0	1.0
16.		5.4	2.0	1.1	1.1	1.4
		4.8	1.6	1.1	1.0	1.2
3.	High - 100	4.3	1.4	0.9	1.0	0.9
13.		3.7	1.1	1.1	0.8	0.6
21.		3.8	1.3	1.1	0.9	0.9
		3.9	1.3	1.0	0.9	0.8
4.	Idle	3.6	1.1	1.0	0.9	0.3
12.		3.4	1.1	1.0	0.6	0.8
17.		3.6	1.1	1.0	0.6	0.8
		3.5	1.1	1.0	0.7	0.6
24.	Idle-Acceleration	4.0	1.4	1.1	0.7	1.0
28.		5.8	1.9	1.3	0.7	1.6
31.		5.8	2.0	1.6	0.7	1.4
33.		5.1	1.7	1.3	0.7	1.4
		5.2	1.8	1.3	0.7	1.4
23.	Acceleration	3.1	1.0	1.0	0.6	0.6
25.		3.5	1.1	1.0	0.9	0.7
26.		4.1	1.1	1.0	1.0	1.0
29.		4.6	1.6	1.0	0.9	1.1
		3.8	1.2	1.0	0.9	0.9
22.	Deceleration	2.6	1.0	0.7	0.7	0.3
27.		3.9	1.1	1.0	0.9	0.9
30.		3.4	1.0	1.0	0.7	0.7
32.		3.6	1.0	1.0	0.9	0.9
		3.4	1.0	0.9	0.8	0.7

TABLE C-12. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Opel Rekord
Date: March 21, 1974

Dilution Level: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	3.9	1.3	0.9	0.9	0.7
14.		3.2	1.1	1.0	0.7	0.4
18.		3.5	1.0	0.9	1.0	0.7
		3.5	1.1	0.9	0.9	0.6
3.	Inter - 50	3.8	1.2	1.0	0.8	0.8
9.		4.1	1.3	1.0	0.9	0.9
20.		4.2	1.3	1.0	0.9	0.9
		4.0	1.3	1.0	0.9	0.9
7.	Inter - 100	4.5	1.4	1.0	0.9	1.0
12.		3.7	1.1	1.0	0.9	0.7
16.		3.1	1.0	1.0	0.7	0.6
		3.8	1.2	1.0	0.8	0.8
4.	High - 0	3.8	1.1	1.0	0.8	0.8
8.		2.7	1.0	1.0	0.7	0.2
11.		3.3	1.1	1.0	0.9	0.6
		3.3	1.1	1.0	0.8	0.5
5.	High - 50	4.1	1.2	1.0	0.9	1.0
15.		4.0	1.3	1.0	1.0	0.9
17.		4.3	1.3	1.0	1.0	0.8
		4.1	1.3	1.0	1.0	0.9
1.	High - 100	3.8	1.1	1.0	0.9	0.8
10.		4.2	1.3	1.0	0.9	0.9
21.		4.3	1.3	1.1	0.9	1.0
		4.1	1.2	1.0	0.9	0.9
6.	Idle	2.9	1.0	1.0	0.7	0.3
13.		3.1	1.0	0.9	0.9	0.4
19.		3.1	1.0	1.0	0.9	0.3
		3.0	1.0	1.0	0.8	0.3
24.	Idle-Acceleration	4.7	1.6	1.1	1.0	1.3
26.		5.4	2.0	1.3	0.9	1.4
29.		4.3	1.5	1.1	0.9	1.0
32.		4.8	1.5	1.0	1.0	1.3
		4.8	1.7	1.1	1.0	1.3
22.	Acceleration	3.3	1.0	1.0	0.9	0.8
27.		4.2	1.1	1.0	1.0	1.0
30.		3.7	1.1	1.0	0.9	0.8
33.		3.6	1.1	1.0	0.9	0.6
		3.7	1.1	1.0	0.9	0.8
23.	Deceleration	3.0	1.0	0.9	0.8	0.8
25.		3.6	1.0	0.9	0.9	0.8
28.		3.1	1.1	1.0	0.4	0.6
31.		3.3	1.1	1.0	0.8	0.5
		3.3	1.1	1.0	0.7	0.7

TABLE C-13. ODOR SUMMARY--FORD LTD EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1200 rpm	0	4/12/74	1.8	0.7	0.3	0.7	0
		4/30/74	2.1	0.9	0.5	0.5	0.3
		Average	2.0	0.8	0.4	0.6	0.2
1200 rpm	2X	4/12/74	1.2	0.4	0.2	0.7	0.2
		4/30/74	1.7	0.8	0.4	0.5	0.2
		Average	1.5	0.6	0.3	0.6	0.2
1200 rpm	4X	4/12/74	0.9	0.4	0.2	0.4	0
		4/30/74	1.5	0.5	0.6	0.4	0.2
		Average	1.2	0.5	0.4	0.4	0.1
2000 rpm	0	4/12/74	1.4	0.6	0.4	0.5	0
		4/30/74	1.5	0.7	0.3	0.5	0
		Average	1.5	0.7	0.4	0.5	0
2000 rpm	2X	4/12/74	1.0	0.4	0.3	0.4	0
		4/30/74	1.1	0.5	0.3	0.3	0
		Average	1.1	0.5	0.3	0.4	0
2000 rpm	4X	4/12/74	1.1	0.5	0.4	0.4	0
		4/30/74	1.7	0.8	0.5	0.4	0.1
		Average	1.4	0.7	0.5	0.4	0.1
Idle		4/12/74	1.1	0.4	0.3	0.5	0
		4/30/74	1.3	0.8	0.4	0.1	0.1
		Average	1.2	0.6	0.4	0.3	0.1
Idle-Acceleration		4/12/74	1.1	0.6	0.3	0.2	0.1
		4/30/74	0.8	0.5	0.2	0.2	0
		Average	1.0	0.6	0.3	0.2	0.1
Acceleration		4/12/74	2.2	1.0	0.6	0.5	0.2
		4/30/74	1.5	0.8	0.6	0.3	0.3
		Average	1.9	0.9	0.6	0.4	0.3
Deceleration		4/12/74	1.7	0.8	0.4	0.5	0
		4/30/74	1.7	0.8	0.7	0.3	0.3
		Average	1.7	0.8	0.6	0.4	0.2
Cold Idle		4/9/74	2.7	1.0	0.6	0.9	0.3
		4/10/74	2.2	0	0.3	1.0	0
		4/11/74	2.6	0.4	0.9	1.0	0.3
		4/12/74	1.0	0.4	0.3	0.5	0.1
		4/30/74	1.6	0.8	0.5	0.3	0.1

TABLE C-14. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Ford LTD
Date: April 12, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	2.1	0.7	0.6	0.9	0.1
6.		1.9	0.9	0.4	0.7	0
12.		1.4	0.4	0.3	0.4	0
		1.8	0.7	0.3	0.7	0
1.	Inter - 2X	1.2	0.5	0.1	0.6	0
9.		1.1	0.4	0.3	0.5	0
17.		1.3	0.4	0.3	0.9	0
		1.2	0.4	0.2	0.7	0
5.	Inter - 4X	0.9	0.4	0.3	0.3	0
10.		1.0	0.5	0.3	0.4	0
16.		0.9	0.3	0.1	0.6	0
		0.9	0.4	0.2	0.4	0
4.	High - 0	1.5	0.6	0.6	0.3	0
7.		1.7	0.7	0.4	0.5	0
20.		0.9	0.4	0.1	0.6	0
		1.4	0.6	0.4	0.5	0
11.	High - 2X	1.3	0.5	0.4	0.4	0
15.		0.9	0.3	0.3	0.5	0
21.		0.9	0.4	0.2	0.4	0
		1.0	0.4	0.3	0.4	0
3.	High - 4X	0.9	0.3	0.4	0.3	0
13.		1.7	0.7	0.6	0.5	0
19.		0.7	0.4	0.1	0.4	0
		1.1	0.5	0.4	0.4	0
8.	Idle	1.5	0.7	0.4	0.5	0
14.		0.6	0	0.1	0.5	0
18.		1.2	0.4	0.4	0.6	0
		1.1	0.4	0.3	0.5	0
22.	Idle-Acceleration	1.3	0.6	0.4	0.1	0.2
27.		0.9	0.6	0.2	0.1	0
29.		0.9	0.6	0.1	0.2	0
31.		1.3	0.7	0.4	0.3	0.1
		1.1	0.6	0.3	0.2	0.1
23.	Acceleration	2.4	1.0	0.3	0.9	0.3
25.		2.4	0.9	0.4	0.9	0.
28.		2.2	1.0	0.9	0.1	0.1
30.		1.9	0.9	0.6	0.1	0.1
		2.2	1.0	0.6	0.5	0.2
24.	Deceleration	1.4	0.7	0.1	0.5	0
26.		2.3	1.0	0.6	0.8	0.3
32.		2.0	1.0	0.6	0.4	0
33.		1.2	0.6	0.3	0.4	0
		1.7	0.8	0.4	0.5	0.1

TABLE C-15. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Ford LTD
Date: April 30, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1.	Inter - 0	2.2	0.8	0.5	0.6	0.3
7.		2.6	1.0	0.9	0.5	0.4
16.		1.6	0.8	0.2	0.3	0.3
		2.1	0.9	0.5	0.5	0.3
6.	Inter - 2X	2.5	0.9	0.6	0.6	0.4
11.		1.4	0.6	0.2	0.6	0
19.		1.3	0.8	0.4	0.4	0.1
		1.7	0.8	0.4	0.5	0.2
5.	Inter - 4X	1.9	0.6	0.9	0.4	0.3
10.		1.3	0.4	0.6	0.5	0
20.		1.2	0.6	0.3	0.4	0.3
		1.5	0.5	0.6	0.4	0.2
9.	High - 0	1.6	0.8	0.6	0.3	0
14.		1.2	0.6	0.3	0.4	0
17.		1.7	0.7	0.1	0.8	0.1
		1.5	0.7	0.3	0.5	0
4.	High - 2X	1.5	0.6	0.4	0.3	0
15.		0.9	0.4	0.1	0.4	0
21.		0.9	0.4	0.4	0.3	0.1
		1.1	0.5	0.3	0.3	0
2.	High - 4X	2.2	1.0	0.9	0.3	0.1
8.		1.8	0.8	0.6	0.4	0.1
13.		1.2	0.6	0.1	0.4	0
		1.7	0.8	0.5	0.4	0.1
3.	Idle	2.3	1.1	0.9	0.2	0.1
12.		0.6	0.4	0.1	0.1	0
18.		0.9	0.8	0.3	0.1	0.1
		1.3	0.8	0.4	0.1	0.1
24.	Idle-Acceleration	0.8	0.6	0.1	0	0.1
28.		0.8	0.3	0.1	0.3	0
30.		0.8	0.4	0.4	0.3	0
31.		0.8	0.5	0.3	0.2	0
		0.8	0.5	0.2	0.2	0
22.	Acceleration	1.3	0.8	0.4	0.4	0.2
26.		1.4	0.8	0.6	0.1	0
29.		1.5	0.5	0.6	0.3	0.4
32.		1.9	0.9	0.7	0.2	0.4
		1.5	0.8	0.6	0.3	0.3
23.	Deceleration	2.1	0.9	0.8	0.4	0.5
25.		1.3	0.6	0.6	0.1	0.1
27.		1.5	0.5	0.6	0.4	0.3
33.		1.7	1.0	0.6	0.1	0.2
		1.7	0.8	0.7	0.3	0.3
	Cold Idle	1.6	0.8	0.5	0.3	0.1

TABLE C-16. ODOR SUMMARY--CAPRI STANDARD EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1700 rpm	0	4/24/74	2.5	0.7	0.7	0.4	0.5
		4/25/74	2.9	0.9	0.8	0.6	0.6
		Average	2.7	0.8	0.8	0.5	0.6
1700 rpm	2X	4/24/74	3.4	0.9	0.8	0.6	0.8
		4/25/74	2.6	0.8	0.7	0.5	0.5
		Average	3.0	0.9	0.8	0.6	0.7
1700 rpm	4X	4/24/74	3.4	0.9	0.8	0.7	0.8
		4/25/74	3.3	0.8	0.9	0.7	0.8
		Average	3.4	0.9	0.9	0.7	0.8
2850 rpm	0	4/24/74	2.6	0.7	0.7	0.5	0.4
		4/25/74	1.7	0.8	0.5	0.4	0.3
		Average	2.2	0.8	0.6	0.5	0.4
2850 rpm	2X	4/24/74	3.5	0.9	0.8	0.5	0.8
		4/25/74	3.4	1.0	0.9	0.7	0.7
		Average	3.5	1.0	0.9	0.6	0.8
2850 rpm	4X	4/24/74	3.1	1.0	0.7	0.5	0.7
		4/25/74	3.4	1.0	1.0	0.6	0.8
		Average	3.3	1.0	0.9	0.6	0.8
Idle		4/24/74	3.2	0.8	0.7	0.6	0.7
		4/25/74	3.3	0.9	0.8	0.7	0.8
		Average	3.3	0.9	0.8	0.7	0.8
Idle-Acceleration		4/24/74	2.8	1.0	1.0	0.5	0.5
		4/25/74	2.3	0.8	0.8	0.3	0.5
		Average	2.6	0.9	0.9	0.4	0.5
Acceleration		4/24/74	3.0	0.9	0.8	0.6	0.7
		4/25/74	3.3	1.1	1.0	0.5	0.6
		Average	3.2	1.0	0.9	0.6	0.7
Deceleration		4/24/74	3.0	1.0	1.0	0.6	0.5
		4/25/74	2.8	1.0	1.0	0.3	0.5
		Average	2.9	1.0	1.0	0.5	0.5
Cold Idle		4/24/74	3.6	1.0	0.8	0.7	0.8
		4/25/74	3.2	0.8	1.0	0.8	0.5
		Average	3.4	0.9	0.9	0.8	0.7

TABLE C-17. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Capri Standard
Date: April 24, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
8.	Inter - 0	2.6	0.7	0.7	0.3	0.6
14.		2.4	0.7	0.7	0.5	0.5
21.		2.6	0.7	0.7	0.5	0.5
		2.5	0.7	0.7	0.4	0.5
1.	Inter - 2X	3.0	0.7	0.8	0.7	0.8
7.		3.9	1.0	0.8	0.6	0.8
17.		3.3	0.9	0.8	0.6	0.8
		3.4	0.9	0.8	0.6	0.8
9.	Inter - 4X	3.6	0.9	0.8	0.6	1.0
11.		4.0	1.1	0.8	0.6	0.8
18.		2.6	0.8	0.8	0.8	0.6
		3.4	0.9	0.8	0.7	0.8
5.	High - 0	2.4	0.6	0.7	0.5	0.5
10.		3.3	0.9	0.7	0.6	0.4
16.		2.1	0.7	0.7	0.5	0.4
		2.6	0.7	0.7	0.5	0.4
2.	High - 2X	4.0	1.2	0.9	0.5	0.9
6.		3.4	0.9	0.8	0.6	0.8
15.		3.0	0.7	0.8	0.5	0.8
		3.5	0.9	0.8	0.5	0.8
4.	High - 4X	2.5	0.9	0.7	0.4	0.5
13.		3.9	1.1	0.8	0.7	1.0
20.		2.9	1.1	0.6	0.5	0.5
		3.1	1.0	0.7	0.5	0.7
3.	Idle	2.5	0.7	0.6	0.7	0.6
12.		3.7	0.9	0.7	0.6	0.7
19.		3.3	0.9	0.7	0.5	0.7
		3.2	0.8	0.7	0.6	0.7
22.	Idle-Acceleration	3.1	1.0	1.0	0.8	0.5
27.		3.3	1.0	1.0	0.5	0.7
30.		2.3	1.0	1.0	0.2	0.3
32.		2.3	0.9	0.8	0.5	0.5
		2.8	1.0	1.0	0.5	0.5
24.	Acceleration	2.7	0.9	0.8	0.6	0.6
26.		3.3	0.7	0.8	0.6	0.8
28.		2.9	0.9	0.6	0.5	0.8
29.		2.9	0.9	0.8	0.5	0.6
		3.0	0.9	0.8	0.6	0.7
23.	Deceleration	2.8	1.0	1.0	0.7	0.4
25.		2.9	1.0	0.8	0.5	0.5
31.		2.9	1.0	1.0	0.5	0.3
33.		3.4	1.0	1.0	0.5	0.7
		3.0	1.0	1.0	0.6	0.5

TABLE C-18. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Capri Standard
Date: April 25, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
3.	Inter - 0	2.6	0.9	0.8	0.5	0.5
10.		2.4	0.8	0.7	0.5	0.3
17.		3.7	1.0	0.8	0.7	1.0
		2.9	0.9	0.8	0.6	0.6
9.	Inter - 2X	2.9	0.8	0.8	0.3	0.8
12.		2.3	1.0	0.7	0.5	0.3
14.		2.6	0.7	0.5	0.7	0.5
		2.6	0.8	0.7	0.5	0.5
5.	Inter - 4X	3.7	1.0	1.0	0.8	0.8
15.		3.3	0.7	1.0	0.7	0.7
18.		3.0	0.8	0.8	0.5	0.8
		3.3	0.8	0.9	0.7	0.8
1.	High - 0	2.1	0.9	0.5	0.6	0.3
8.		1.9	0.8	0.8	0.3	0.3
13.		1.1	0.6	0.2	0.3	0.3
		1.7	0.8	0.5	0.4	0.3
2.	High - 2X	4.0	1.2	1.0	0.8	0.7
7.		2.9	0.8	0.8	0.8	0.5
19.		3.3	1.0	1.0	0.5	0.8
		3.4	1.0	0.9	0.7	0.7
4.	High - 4X	3.9	1.0	1.0	0.8	0.8
11.		3.1	1.0	1.0	0.3	0.8
20.		3.3	1.0	1.0	0.7	0.7
		3.4	1.0	1.0	0.6	0.8
6.	Idle	3.1	0.8	1.0	0.5	0.7
16.		3.3	1.0	0.5	1.0	0.7
21.		3.6	0.8	0.8	0.5	1.0
		3.3	0.9	0.8	0.7	0.8
22.	Idle-Acceleration	2.3	0.8	0.7	0.5	0.5
25.		2.4	0.9	1.0	0.2	0.5
27.		2.4	0.8	1.0	0.3	0.5
33.		2.0	0.8	0.3	0.3	0.3
		2.3	0.8	0.8	0.3	0.5
23.	Acceleration	3.4	1.0	1.0	0.5	0.7
24.		3.0	1.0	1.0	0.5	0.5
29.		3.1	1.3	1.0	0.3	0.5
31.		3.7	1.0	1.0	0.5	0.8
		3.3	1.1	1.0	0.5	0.6
26.	Deceleration	2.7	1.0	1.0	0.3	0.5
28.		2.7	1.0	1.0	0.2	0.7
30.		2.6	1.0	1.0	0.2	0.3
32.		3.1	1.0	0.8	0.3	0.5
		2.8	1.0	1.0	0.3	0.5
	Cold Idle	3.2	0.8	1.0	0.8	0.5

TABLE C-19. ODOR SUMMARY--CAPRI PROCO EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1700 rpm	0	5/7/74	0.7	0.3	0.1	0.3	0
		5/9/74	0.8	0.4	0.1	0.1	0
		Average	0.8	0.4	0.1	0.2	0
1700 rpm	2X	5/7/74	0.8	0.3	0.1	0.3	0.1
		5/9/74	0.7	0.4	0.1	0.2	0
		Average	0.8	0.4	0.1	0.3	0.1
1700 rpm	4X	5/7/74	1.3	0.5	0.2	0.4	0.2
		5/9/74	0.7	0.3	0.1	0.1	0
		Average	1.0	0.4	0.2	0.3	0.1
2850 rpm	0	5/7/74	1.0	0.5	0.1	0.3	0
		5/9/74	0.6	0.3	0.2	0.1	0
		Average	0.8	0.4	0.2	0.2	0
2850 rpm	2X	5/7/74	1.4	0.5	0.4	0.3	0.2
		5/9/74	0.8	0.4	0.2	0.1	0
		Average	1.1	0.5	0.3	0.2	0.1
2850 rpm	4X	5/7/74	1.4	0.5	0.4	0.5	0.1
		5/9/74	1.1	0.4	0.2	0.2	0
		Average	1.3	0.5	0.3	0.4	0.1
Idle		5/7/74	0.7	0.2	0.1	0.5	0.1
		5/9/74	0.6	0.4	0.1	0.1	0
		Average	0.7	0.3	0.1	0.3	0.1
Idle-Acceleration		5/7/74	1.1	0.6	0.1	0.2	0.1
		5/9/74	0.8	0.4	0.2	0.3	0.1
		Average	1.0	0.5	0.2	0.3	0.1
Acceleration		5/7/74	3.4	0.9	0.8	0.8	1.0
		5/9/74	2.9	1.0	0.9	0.2	0.8
		Average	3.1	1.0	0.9	0.5	0.9
Deceleration		5/7/74	1.1	0.5	0.2	0.2	0.1
		5/9/74	0.5	0.3	0.2	0.1	0
		Average	0.8	0.4	0.2	0.2	0.1
Cold Idle		5/7/74	4.7	1.1	0.6	0.9	1.0
		5/9/74	3.9	0.9	0.9	0.6	0.7
		Average	4.3	1.0	0.8	0.8	0.9

TABLE C-20. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Capri PROCO
Date: May 7, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
8.	Inter - 0	0.7	0.4	0.1	0.3	0
12.		0.6	0.1	0.1	0.3	0.1
19.		0.9	0.4	0.1	0.3	0
		0.7	0.3	0.1	0.3	0
5.	Inter - 2X	0.8	0.3	0.3	0.1	0.1
14.		0.8	0.3	0	0.3	0.1
16.		0.7	0.3	0	0.4	0
		0.8	0.3	0.1	0.3	0.1
4.	Inter - 4X	1.1	0.5	0.3	0.2	0.1
7.		1.6	0.8	0.4	0.6	0.3
15.		1.1	0.3	0	0.4	0.3
		1.3	0.5	0.2	0.4	0.2
1.	High - 0	1.2	0.6	0.1	0.5	0.1
13.		0.8	0.4	0	0.3	0
20.		0.9	0.6	0.2	0	0
		1.0	0.5	0.1	0.3	0
2.	High - 2X	1.0	0.6	0.2	0.1	0.1
11.		1.0	0.1	0.3	0.6	0.1
18.		2.1	0.9	0.6	0.1	0.4
		1.4	0.5	0.4	0.3	0.2
6.	High - 4X	2.1	0.8	0.6	0.5	0.3
9.		1.3	0.3	0.4	0.8	0
21.		0.8	0.4	0.3	0.2	0
		1.4	0.5	0.4	0.5	0.1
3.	Idle	0.9	0.4	0.3	0.3	0
10.		0.9	0.3	0.1	0.7	0.1
17.		0.3	0	0	0.4	0
		0.7	0.2	0.1	0.5	0
22.	Idle-Acceleration	1.5	0.6	0.1	0.4	0.3
27.		0.9	0.5	0.1	0.2	0.1
29.		0.8	0.6	0.1	0.1	0.1
33.		1.0	0.6	0.2	0	0
		1.1	0.6	0.1	0.2	0.1
23.	Acceleration	3.4	1.0	0.6	0.7	0.9
25.		3.4	0.9	0.9	0.6	1.0
28.		3.6	0.9	0.9	0.9	1.0
32.		3.2	0.9	0.9	0.8	0.9
		3.4	0.9	0.8	0.8	1.0
24.	Deceleration	1.3	0.6	0.4	0.1	0.1
26.		1.3	0.6	0.2	0.2	0.3
30.		0.7	0.4	0	0.1	0
31.		1.1	0.5	0.3	0.3	0
		1.1	0.5	0.2	0.2	0.1
	Cold Idle	4.7	1.1	0.6	0.9	1.0

TABLE C-21. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Capri PROCO
Date: May 9, 1974

Dilution Ratio: 100:1

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
3.	Inter - 0	0.9	0.4	0.1	0.1	0
10.		0.6	0.4	0.1	0	0
14.		0.8	0.4	0.1	0.1	0
		0.8	0.4	0.1	0.1	0
6.	Inter - 2X	0.7	0.3	0.1	0.2	0
8.		0.6	0.4	0.1	0	0
17.		0.9	0.4	0.1	0.3	0
		0.7	0.4	0.1	0.2	0
7.	Inter - 4X	0.4	0.1	0.1	0	0
15.		0.8	0.3	0.1	0.3	0
18.		0.8	0.4	0.1	0.1	0
		0.7	0.3	0.1	0.1	0
2.	High - 0	0.9	0.4	0.3	0.2	0
9.		0.4	0.2	0.1	0	0
21.		0.5	0.3	0.1	0	0
		0.6	0.3	0.2	0.1	0
4.	High - 2X	1.0	0.5	0.2	0.2	0
11.		0.9	0.5	0.2	0	0
20.		0.4	0.3	0.1	0	0
		0.8	0.4	0.2	0.1	0
1.	High - 4X	1.5	0.6	0.3	0.4	0.1
13.		0.9	0.3	0.1	0.2	0
16.		0.9	0.4	0.3	0.1	0
		1.1	0.4	0.2	0.2	0
5.	Idle	0.7	0.3	0.1	0.1	0
12.		0.6	0.4	0.1	0.1	0
19.		0.6	0.4	0.1	0	0
		0.6	0.4	0.1	0.1	0
22.	Idle-Acceleration	0.6	0.3	0	0.2	0
26.		1.1	0.4	0.5	0.4	0.2
28.		0.8	0.3	0.2	0.3	0
33.		0.8	0.4	0.2	0.2	0
		0.8	0.4	0.2	0.3	0.1
23.	Acceleration	3.3	1.0	0.9	0.3	0.8
27.		3.1	1.0	1.0	0.2	0.9
30.		2.3	0.8	0.8	0.2	0.7
32.		3.0	1.0	0.8	0.2	0.8
		2.9	1.0	0.9	0.2	0.8
24.	Deceleration	0.6	0.4	0.1	0	0
25.		0.4	0.1	0.2	0.2	0
29.		0.6	0.3	0.1	0.2	0
31.		0.4	0.5	0.2	0	0
		0.5	0.3	0.2	0.1	0
	Cold Idle	3.9	0.9	0.9	0.6	0.7

TABLE C-22. ODOR SUMMARY--TEXACO TCCS CRICKET, DIESEL
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1800 rpm	0	10/15/74	6.0	2.0	1.5	1.1	1.3
		10/17/74	5.4	1.8	1.2	1.0	1.3
		Average	5.7	1.9	1.4	1.1	1.3
1800 rpm 53.1 km/hr	1.5X	10/15/74	5.4	1.8	1.2	0.9	1.3
		10/17/74	5.3	1.6	1.1	1.1	1.3
		Average	5.4	1.7	1.2	1.0	1.3
1800 rpm 53.1 km/hr	3X	10/15/74	5.7	1.8	1.5	0.9	1.4
		10/17/74	4.3	1.3	1.1	1.1	0.9
		Average	5.0	1.6	1.3	1.0	1.2
3000 rpm	0	10/15/74	6.1	2.1	1.6	0.9	1.5
		10/17/74	6.0	2.0	1.4	0.9	1.5
		Average	6.1	2.1	1.5	0.9	1.5
3000 rpm 90.1 km/hr	1.5X	10/15/74	4.2	1.4	1.1	0.9	0.8
		10/17/74	4.6	1.4	1.1	1.0	0.9
		Average	4.4	1.4	1.1	1.0	0.9
3000 rpm 90.1 km/hr	3X	10/15/74	4.8	1.6	1.2	0.8	1.0
		10/17/74	4.7	1.5	1.2	0.9	1.1
		Average	4.8	1.6	1.2	0.9	1.1
Idle		10/15/74	4.8	1.6	1.2	0.9	1.0
		10/17/74	5.7	1.6	1.2	1.2	1.5
		Average	5.3	1.6	1.2	1.1	1.3
Idle-Acceleration		10/15/74	6.1	2.0	1.4	0.9	1.9
		10/17/74	5.3	1.9	1.2	1.0	1.4
		Average	5.7	2.0	1.3	1.0	1.7
Acceleration		10/15/74	5.0	1.5	1.1	1.1	1.2
		10/17/74	4.9	1.6	1.3	1.1	1.0
		Average	5.0	1.6	1.2	1.1	1.1
Deceleration		10/15/74	5.0	1.6	1.2	0.9	1.1
		10/17/74	4.8	1.6	1.0	1.1	1.2
		Average	4.9	1.6	1.1	1.0	1.2
Cold Start		10/15/74	3.5	0.9	0.9	0.7	0.9
		10/17/74	5.4	1.6	1.1	0.9	1.3
		Average	4.5	1.3	1.0	0.8	1.1

TABLE C-23. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Texaco TCCS Cricket - Diesel
Date: October 15, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
7.	Inter - 0	6.3	2.1	1.6	1.1	1.4
12.		6.3	2.1	1.6	1.0	1.5
14.		5.4	1.9	1.4	1.1	1.0
		6.0	2.0	1.5	1.1	1.3
6.	Inter - 1.5X	5.4	2.0	1.1	1.0	1.1
17.		4.8	1.3	1.1	0.7	1.1
21.		6.1	2.1	1.4	0.9	1.6
		5.4	1.8	1.2	0.9	1.3
3.	Inter - 3X	4.3	1.1	1.0	1.0	0.9
8.		6.3	2.1	1.9	0.7	1.6
15.		6.4	2.1	1.7	0.9	1.6
		5.7	1.8	1.5	0.9	1.4
2.	High - 0	5.6	2.0	1.3	0.9	1.4
9.		6.6	2.3	2.0	0.9	1.6
18.		6.1	2.0	1.4	0.9	1.4
		6.1	2.1	1.6	0.9	1.5
1.	High - 1.5X	2.8	0.9	1.0	0.6	0.4
10.		5.5	1.9	1.3	1.1	1.0
16.		4.4	1.4	0.9	1.0	1.0
		4.2	1.4	1.1	0.9	0.8
4.	High - 3X	3.6	1.1	1.0	0.6	0.9
13.		5.4	1.9	1.4	0.7	1.1
19.		5.3	1.7	1.3	1.0	1.0
		4.8	1.6	1.2	0.8	1.0
5.	Idle	3.8	1.3	1.0	0.6	1.0
11.		5.4	1.9	1.2	1.0	1.0
20.		5.2	1.6	1.4	1.0	1.0
		4.8	1.6	1.2	0.9	1.0
23.	Idle-Acceleration	5.6	1.9	1.3	0.9	1.7
26.		5.9	1.9	1.4	1.0	1.9
31.		6.4	2.3	1.4	0.6	2.0
33.		6.4	2.0	1.6	1.0	1.9
		6.1	2.0	1.4	0.9	1.9
22.	Acceleration	4.4	1.1	1.0	1.0	1.1
25.		4.6	1.1	0.9	1.1	1.1
29.		5.1	1.7	1.1	1.3	1.0
32.		6.0	2.1	1.4	0.9	1.7
		5.0	1.5	1.1	1.1	1.2
24.	Deceleration	4.5	1.3	1.1	0.9	1.1
27.		4.9	1.4	1.4	1.0	1.0
28.		5.3	1.7	1.1	0.9	1.3
30.		5.3	1.9	1.3	0.9	1.1
		5.0	1.6	1.2	0.9	1.1
A.	Cold Start	3.5	0.9	0.9	0.7	0.9

TABLE C-24. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Texaco TCCS Cricket - Diesel
Date: October 17, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
8.	Inter - 0	5.5	2.0	1.0	1.1	1.3
10.		4.8	1.4	1.1	1.0	1.1
15.		5.9	2.0	1.4	0.9	1.6
		5.4	1.8	1.2	1.0	1.3
1.	Inter - 1.5X	4.5	1.4	1.0	1.1	0.9
5.		5.1	1.4	1.1	1.1	1.3
16.		6.2	2.1	1.1	1.1	1.6
		5.3	1.6	1.1	1.1	1.3
7.	Inter - 3X	3.8	1.1	0.9	0.9	0.9
14.		4.8	1.4	1.1	1.1	0.9
19.		5.3	1.3	1.3	1.3	1.0
		4.3	1.3	1.1	1.1	0.9
4.	High - 0	5.3	1.9	1.3	0.9	1.1
13.		6.5	2.0	1.6	1.0	1.9
20.		6.1	2.0	1.4	0.9	1.4
		6.0	2.0	1.4	0.9	1.5
6.	High - 1.5X	3.6	1.0	1.0	1.0	0.6
12.		5.5	1.9	1.4	0.9	1.0
21.		4.6	1.4	0.9	1.0	1.0
		4.6	1.4	1.1	1.0	0.9
3.	High - 3X	4.1	1.4	1.1	0.9	1.0
9.		4.0	1.3	1.0	0.9	1.0
18.		6.0	1.7	1.4	1.1	1.4
		4.7	1.5	1.2	0.9	1.1
2.	Idle	5.3	1.6	1.0	1.6	1.3
11.		6.3	1.7	1.4	1.0	1.7
17.		5.5	1.6	1.3	1.0	1.4
		5.7	1.6	1.2	1.2	1.5
24.	Idle-Acceleration	5.9	2.2	1.3	0.8	1.7
27.		5.0	1.7	1.2	1.2	1.2
29.		5.4	1.8	1.3	1.0	1.3
32.		4.9	1.7	1.0	1.0	1.2
		5.3	1.9	1.2	1.0	1.4
23.	Acceleration	4.1	1.2	1.2	1.0	0.7
26.		4.9	1.5	1.3	0.8	1.0
30.		4.9	1.5	1.3	1.2	1.0
33.		5.7	2.0	1.3	1.2	1.3
		4.9	1.6	1.3	1.1	1.0
22.	Deceleration	4.6	1.5	0.8	1.2	1.0
25.		4.7	1.5	0.8	1.2	1.2
28.		5.1	1.7	1.3	1.0	1.2
31.		4.7	1.8	1.2	1.0	1.2
		4.8	1.6	1.0	1.1	1.2
A.	Cold Start	5.4	1.6	1.1	0.9	1.3

TABLE C-25. ODOR SUMMARY--TEXACO TCCS CRICKET, GASOLINE
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1800 rpm	0	10/8/74	3.7	1.3	0.8	0.7	1.1
		10/11/74	4.5	1.4	0.9	0.8	1.3
		Average	4.1	1.4	0.9	0.8	1.2
1800 rpm	1.5X	10/8/74	2.8	1.0	0.9	0.6	0.7
53.1 km/hr		10/11/74	3.2	1.0	0.8	0.7	0.8
		Average	3.0	1.0	0.9	0.7	0.8
1800 rpm	3X	10/8/74	3.4	1.0	0.8	0.6	0.8
53.1 km/hr		10/11/74	3.0	1.1	0.8	0.7	0.6
		Average	3.2	1.1	0.8	0.7	0.7
3000 rpm	0	10/8/74	3.9	1.3	1.0	0.8	0.9
		10/11/74	4.1	1.3	1.1	0.6	1.2
		Average	4.0	1.3	1.1	0.7	1.1
3000 rpm	1.5X	10/8/74	2.9	1.0	0.9	0.5	0.7
90.1 km/hr		10/11/74	2.5	0.9	0.8	0.5	0.6
		Average	2.7	1.0	0.9	0.5	0.7
3000 rpm	3X	10/8/74	3.3	1.1	0.9	0.7	0.8
90.1 km/hr		10/11/74	3.0	1.0	0.9	0.6	0.6
		Average	3.2	1.1	0.9	0.7	0.7
Idle		10/8/74	2.7	1.0	0.8	0.5	0.4
		10/11/74	3.1	1.1	0.8	0.7	0.9
		Average	2.9	1.1	0.8	0.6	0.7
Idle-Acceleration		10/8/74	2.5	1.0	0.7	0.5	0.5
		10/11/74	3.0	1.0	0.6	0.7	0.8
		Average	2.8	1.0	0.7	0.6	0.7
Acceleration		10/8/74	2.5	1.0	0.7	0.4	0.5
		10/11/74	2.8	0.8	0.9	0.5	0.7
		Average	2.7	0.9	0.8	0.5	0.6
Deceleration		10/8/74	2.3	1.0	0.6	0.4	0.4
		10/11/74	2.7	0.9	0.9	0.5	0.6
		Average	2.5	1.0	0.8	0.5	0.5
Cold Start		10/8/74	3.8	1.6	1.0	0.6	0.8
		10/10/74	4.2	1.3	0.9	0.7	1.0
		10/11/74	3.1	0.8	0.7	0.7	1.0
		Average	3.7	1.2	0.9	0.7	0.9

TABLE C-26. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Texaco TCCS Cricket - Gasoline
Date: October 8, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
7.	Inter - 0	3.9	1.1	1.0	0.9	1.0
13.		3.9	1.6	0.8	0.6	1.3
15.		3.2	1.1	0.7	0.7	1.0
		3.7	1.3	0.8	0.7	1.1
2.	Inter - 1.5X	3.6	1.1	1.0	0.6	1.0
12.		2.6	1.0	0.9	0.4	0.4
19.		2.3	0.9	0.7	0.7	0.6
		2.8	1.0	0.9	0.6	0.7
3.	Inter - 3X	3.7	1.1	1.0	0.6	1.0
9.		3.6	1.0	0.7	0.8	0.9
16.		2.8	1.0	0.7	0.4	0.6
		3.4	1.0	0.8	0.6	0.8
4.	High - 0	3.5	1.0	1.0	0.8	0.7
8.		4.2	1.4	1.0	0.9	0.9
20.		4.1	1.4	0.9	0.7	1.1
		3.9	1.3	1.0	0.8	0.9
5.	High - 1.5X	3.3	1.1	1.0	0.4	0.9
11.		3.2	1.0	0.9	0.7	0.7
21.		2.8	0.9	0.9	0.7	0.5
		3.1	1.0	0.9	0.6	0.7
6.	High - 3X	3.0	1.0	0.9	0.6	0.7
14.		3.8	1.2	1.0	0.7	1.0
18.		3.1	1.0	0.9	0.9	0.6
		3.3	1.1	0.9	0.7	0.8
1.	Idle	2.8	1.0	1.0	0.4	0.6
10.		2.6	1.0	0.9	0.5	0.4
17.		2.6	1.0	0.7	0.6	0.2
		2.7	1.0	0.8	0.5	0.4
22.	Idle-Acceleration	2.3	0.9	0.7	0.4	0.4
24.		2.4	0.9	0.6	0.7	0.4
29.		2.8	1.0	0.9	0.5	0.6
32.		2.4	1.0	0.6	0.4	0.6
		2.5	1.0	0.7	0.5	0.5
23.	Acceleration	2.6	1.0	0.6	0.5	0.4
26.		2.1	0.9	0.9	0.3	0.3
30.		2.6	1.1	0.7	0.4	0.6
33.		2.8	1.0	0.7	0.3	0.7
		2.5	1.0	0.7	0.4	0.5
25.	Deceleration	2.5	1.0	0.7	0.4	0.6
27.		2.1	0.9	0.7	0.3	0.3
28.		2.3	1.0	0.6	0.7	0.3
31.		2.2	0.9	0.4	0.3	0.4
		2.3	1.0	0.6	0.4	0.4
A.	Cold Start	3.8	1.6	1.0	0.6	0.8

TABLE C-27. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Texaco TCCS Cricket - Gasoline
Date: October 11, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
7.	Inter - 0	4.5	1.3	0.8	1.0	1.0
9.		4.1	1.3	0.8	0.8	1.2
15.		4.9	1.5	1.0	0.7	1.7
		4.5	1.4	0.9	0.8	1.3
3.	Inter - 1.5X	3.3	1.0	1.0	0.5	0.8
10.		4.1	1.3	0.8	0.8	1.2
20.		2.3	0.8	0.7	0.7	0.5
		3.2	1.0	0.8	0.7	0.8
6.	Inter - 3X	3.0	1.0	0.8	0.7	0.7
13.		3.0	1.2	0.7	0.7	0.5
19.		2.9	1.0	1.0	0.7	0.7
		3.0	1.1	0.8	0.7	0.6
2.	High - 0	3.9	1.2	1.0	0.7	1.0
14.		4.4	1.5	1.2	0.5	1.3
18.		4.1	1.2	1.0	0.7	1.2
		4.1	1.3	1.1	0.6	1.2
1.	High - 1.5X	2.1	1.0	0.5	0.5	0.7
11.		2.4	1.0	1.0	0.3	0.3
17.		3.0	0.8	1.0	0.7	0.8
		2.5	0.9	0.8	0.5	0.6
4.	High - 3X	2.5	1.0	0.7	0.7	0.5
8.		2.6	0.8	0.8	0.3	0.5
16.		3.9	1.2	1.2	0.8	0.7
		3.0	1.0	0.9	0.6	0.6
5.	Idle	1.7	0.8	0.8	0.5	0.2
12.		3.7	1.2	0.8	0.7	1.2
21.		3.9	1.2	0.8	0.8	1.2
		3.1	1.1	0.8	0.7	0.9
23.	Idle-Acceleration	3.3	1.0	0.7	1.0	0.8
26.		2.4	0.8	0.6	0.6	0.5
28.		3.0	1.2	0.3	0.6	1.0
31.		3.3	1.0	0.8	0.6	0.8
		3.0	1.0	0.6	0.7	0.8
22.	Acceleration	2.8	0.8	0.8	0.8	0.6
25.		2.7	0.8	0.8	0.6	0.6
29.		2.3	0.8	0.8	0.2	0.6
32.		3.2	0.8	1.0	0.3	0.8
		2.8	0.8	0.9	0.5	0.7
24.	Deceleration	2.3	0.8	1.0	0.3	0.3
27.		1.8	0.8	0.6	0.3	0.2
30.		3.0	1.0	0.8	0.6	1.0
33.		3.5	0.8	1.0	0.8	0.8
		2.7	0.9	0.9	0.5	0.6
A.	Cold Start	3.1	0.8	0.7	0.7	1.0

TABLE C-28. ODOR SUMMARY--HONDA CVCC CIVIC EVALUATION
100:1 Dilution

Condition	Load	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2300 rpm	0	10/31/74	2.4	0.8	0.6	0.6	0.6
		11/5/74	1.7	0.5	0.5	0.5	0.3
		Average	2.1	0.7	0.6	0.6	0.5
2300 rpm	1.5X	10/31/74	1.4	0.7	0.5	0.3	0.2
54.2 km/hr		11/5/74	1.5	0.7	0.5	0.4	0.2
		Average	1.5	0.7	0.5	0.4	0.2
2300 rpm	3X	10/31/74	1.4	0.6	0.5	0.5	0
54.2 km/hr		11/5/74	1.5	0.7	0.4	0.5	0.4
		Average	1.5	0.7	0.5	0.5	0.2
3800 rpm	0	10/31/74	2.2	0.8	0.6	0.5	0.4
		11/5/74	1.6	0.7	0.4	0.4	0.3
		Average	1.9	0.8	0.5	0.5	0.4
3800 rpm	1.5X	10/31/74	1.5	0.7	0.5	0.6	0.3
90.1 km/hr		11/5/74	1.7	0.6	0.5	0.6	0.3
		Average	1.6	0.7	0.5	0.6	0.3
3800 rpm	3X	10/31/74	1.7	0.6	0.6	0.5	0.2
90.1 km/hr		11/5/74	1.5	0.7	0.4	0.5	0.2
		Average	1.6	0.7	0.5	0.5	0.2
Idle		10/31/74	3.4	1.0	0.9	0.8	0.9
		11/5/74	2.9	0.9	0.6	0.7	0.8
		Average	3.2	1.0	0.8	0.8	0.9
Idle-Acceleration		10/31/74	3.3	1.1	0.9	0.7	0.8
		11/5/74	3.5	1.1	0.8	0.7	0.9
		Average	3.4	1.1	0.9	0.7	0.9
Acceleration		10/31/74	4.4	1.6	1.1	0.8	1.1
		11/5/74	4.4	1.4	1.0	0.8	1.1
		Average	4.4	1.5	1.0	0.8	1.1
Deceleration		10/31/74	2.7	1.0	0.8	0.5	0.6
		11/5/74	2.5	0.8	0.8	0.5	0.6
		Average	2.6	0.9	0.8	0.5	0.6
Cold Start		10/29/74	4.1	1.3	0.9	1.0	0.9
		10/31/74	4.0	1.1	0.9	0.9	0.9
		11/5/74	4.3	1.1	1.0	1.1	1.0
		Average	4.1	1.2	0.9	1.0	0.9

TABLE C-29. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Honda CVCC Civic
Date: October 31, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1.	Inter - 0	3.1	1.0	1.0	0.7	0.8
7.		2.1	0.7	0.5	0.6	0.4
12.		2.1	0.8	0.4	0.4	0.5
		2.4	0.8	0.6	0.6	0.6
5.	Inter - 1.5X	1.2	0.5	0.4	0.4	0.1
11.		2.1	0.9	0.6	0.3	0.4
17.		1.0	0.6	0.4	0.3	0.1
		1.4	0.7	0.5	0.3	0.2
6.	Inter - 3X	1.6	0.6	0.5	0.6	0.1
15.	(high by 3 hp)	1.3	0.7	0.4	0.4	0
21.		1.4	0.6	0.5	0.4	0
		1.4	0.6	0.5	0.5	0
2.	High - 0	1.6	0.9	0.6	0.5	0.3
14.		1.9	0.8	0.6	0.3	0.1
19.		3.1	0.7	0.7	0.6	0.7
		2.2	0.8	0.6	0.5	0.4
8.	High - 1.5X	1.6	0.7	0.3	0.5	0.2
13.	(low by 3 hp)	1.5	0.6	0.5	0.7	0.4
20.		1.4	0.8	0.6	0.6	0.3
		1.5	0.7	0.5	0.6	0.3
4.	High - 3X	2.0	0.6	0.9	0.5	0.3
10.		2.0	0.9	0.5	0.6	0.4
16.		1.1	0.4	0.3	0.4	0
		1.7	0.6	0.6	0.5	0.2
3.	Idle	3.1	0.9	0.9	0.7	0.9
9.		3.3	1.1	0.9	0.7	0.7
18.		3.7	1.1	0.9	0.9	1.0
		3.4	1.0	0.9	0.8	0.9
22.	Idle-Acceleration	2.5	0.8	0.8	0.7	0.4
25.		3.7	1.2	1.0	0.7	0.8
29.		3.3	1.0	0.7	0.8	1.0
31.		3.8	1.3	1.0	0.7	0.8
		3.3	1.1	0.9	0.7	0.8
23.	Acceleration	4.3	1.5	1.0	0.8	1.2
27.		4.7	1.7	1.0	0.8	1.3
30.		4.3	1.5	1.2	0.8	1.0
32.		4.2	1.5	1.2	0.7	1.0
		4.4	1.6	1.1	0.8	1.1
24.	Deceleration	2.7	1.0	0.7	0.5	0.7
26.		2.7	0.8	0.7	0.7	0.7
28.		2.3	0.8	0.8	0.5	0.5
33.		3.0	1.2	1.0	0.3	0.5
		2.7	1.0	0.8	0.5	0.6
A.	Cold Start	4.0	1.1	0.9	0.9	0.9

TABLE C-30. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Honda CVCC Civic
Date: November 5, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1.	Inter - 0	1.8	0.4	0.5	0.5	0.4
7.		1.6	0.4	0.6	0.5	0.3
12.		1.7	0.7	0.4	0.5	0.3
		1.7	0.5	0.5	0.5	0.3
5.	Inter - 1.5X	1.4	0.9	0.4	0.4	0.1
11.		1.9	0.6	0.8	0.5	0.5
17.		1.1	0.6	0.4	0.4	0
		1.5	0.7	0.5	0.4	0.2
8.	Inter - 3X	1.4	0.6	0.4	0.4	0.4
13.		1.7	0.8	0.4	0.4	0.4
20.		1.4	0.6	0.3	0.8	0.3
		1.5	0.7	0.4	0.5	0.4
2.	High - 0	1.3	0.6	0.5	0.3	0
14.		1.2	0.8	0.2	0.3	0.1
19.		2.3	0.7	0.4	0.7	0.7
		1.6	0.7	0.4	0.4	0.3
6.	High - 1.5X	1.9	0.4	0.7	0.6	0.3
15.		1.4	0.6	0.4	0.6	0.3
21.		1.7	0.8	0.4	0.6	0.3
		1.7	0.6	0.5	0.6	0.3
4.	High - 3X	1.5	0.8	0.5	0.6	0.1
10.		1.8	0.8	0.5	0.4	0.4
16.		1.3	0.6	0.2	0.6	0.1
		1.5	0.7	0.4	0.5	0.2
3.	Idle	3.1	1.0	0.7	0.7	0.9
9.		2.9	0.7	0.7	0.6	0.9
18.		2.7	0.9	0.5	0.7	0.6
		2.9	0.9	0.6	0.7	0.8
22.	Idle-Acceleration	2.9	1.0	0.5	0.5	0.9
25.		3.5	1.1	0.9	0.7	1.0
29.		2.8	1.0	0.9	0.6	0.6
31.		4.6	1.3	1.0	1.0	1.1
		3.5	1.1	0.8	0.7	0.9
23.	Acceleration	4.4	1.4	1.0	0.9	1.1
27.		4.3	1.4	1.0	0.9	1.1
30.		4.4	1.1	1.0	0.7	1.0
32.		4.4	1.6	1.0	0.7	1.0
		4.4	1.4	1.0	0.8	1.1
24.	Deceleration	2.5	1.0	0.9	0.5	0.3
26.		2.4	0.6	0.6	0.6	0.5
28.		3.0	1.0	1.0	0.6	0.9
33.		2.1	0.7	0.5	0.3	0.7
		2.5	0.8	0.8	0.5	0.6
A.	Cold Start	4.3	1.1	1.0	1.1	1.0

TABLE C-31. COMPARISON OF ODOR PANEL RATINGS
Chrysler Gas Turbine

Operating Condition	Date	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
1272 rpm (1)	9/23/74	1.4	0.8	0.4	0.4	0.1
0 load	9/25/74	1.2	0.7	0.4	0.3	0.1
	9/27/74	1.3	0.8	0.4	0.2	0.2
	Average	1.3	0.8	0.4	0.3	0.1
1272 rpm	9/23/74	1.2	0.8	0.2	0.2	0.1
53.1 km/hr	9/25/74	1.1	0.6	0.3	0.3	0.1
2X load	9/27/74	1.1	0.7	0.4	0.4	0.1
	Average	1.1	0.7	0.3	0.3	0.1
1272 rpm	9/23/74	1.0	0.8	0.4	0.1	0
53.1 km/hr	9/25/74	0.8	0.6	0.3	0.2	0
4X load	9/27/74	1.4	0.7	0.4	0.4	0.2
	Average	1.1	0.7	0.4	0.2	0.1
2120 rpm	9/23/74	1.1	0.7	0.2	0.1	0.1
0 load	9/25/74	0.8	0.6	0.1	0.2	0.1
	9/27/74	1.1	0.6	0.4	0.4	0.1
	Average	1.0	0.6	0.2	0.2	0.1
2120 rpm	9/23/74	0.8	0.7	0.2	0	0
90.1 km/hr	9/25/74	0.9	0.7	0.2	0.1	0
2X load	9/27/74	1.3	0.7	0.3	0.3	0.2
	Average	1.0	0.7	0.2	0.1	0.1
2120 rpm	9/23/74	1.5	0.9	0.6	0.3	0.1
90.1 km/hr	9/25/74	1.0	0.5	0.2	0.4	0
4X load	9/27/74	1.1	0.8	0.3	0.1	0.1
	Average	1.2	0.7	0.4	0.3	0.1
Idle	9/23/74	1.8	0.9	0.5	0.5	0.1
	9/25/74	1.4	0.7	0.2	0.4	0.3
	9/27/74	1.4	0.6	0.4	0.4	0.1
	Average	1.5	0.7	0.4	0.4	0.2
Idle-Acceleration	9/23/74	0.9	0.6	0.2	0.1	0.1
	9/25/74	0.6	0.5	0.2	0	0
	9/27/74	1.0	0.5	0.1	0.4	0.1
	Average	0.8	0.5	0.2	0.2	0.1
Acceleration	9/23/74	0.7	0.5	0.2	0.1	0
	9/25/74	0.8	0.4	0.3	0.3	0.1
	9/27/74	1.0	0.5	0.2	0.2	0.1
	Average	0.8	0.5	0.2	0.2	0.1
Deceleration	9/23/74	0.9	0.6	0.3	0.2	0.1
	9/25/74	0.9	0.6	0.2	0.1	0
	9/27/74	0.9	0.5	0.2	0.2	0.1
	Average	0.9	0.6	0.2	0.2	0.1
Deceleration -	9/23/74	0.7	0.5	0.3	0.1	0
Relight	9/25/74	0.6	0.5	0.2	0	0
	9/27/74	1.0	0.5	0.2	0.2	0.1
	Average	0.8	0.5	0.2	0.1	0
Hot Start	9/23/74	1.5	0.8	0.4	0.3	0.1
	9/25/74	1.2	0.7	0.3	0.2	0.2
	9/27/74	1.3	0.6	0.3	0.3	0.1
	Average	1.3	0.7	0.3	0.3	0.1
Cold Start	9/18/74	3.0	1.0	0.8	0	0.8
	9/19/74	3.5	1.1	0.8	0.3	1.0
	9/23/74	3.3	1.1	0.9	0.8	0.4
	9/24/74	4.5	1.3	1.0	0.8	1.0
	9/25/74	4.1	1.3	1.0	0.9	0.9
	9/26/74	4.0	1.0	1.0	0.5	1.0
	9/27/74	3.6	1.0	0.9	0.7	1.0
	Average	3.7	1.1	0.9	0.6	0.9

(1) Power Turbine.

Vehicle: Chrysler Gas Turbine
Date: September 23, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
10.	Inter - 0	1.9	0.9	0.4	0.8	0.2
12.		0.9	0.7	0.3	0	0
25.		1.5	0.7	0.4	0.4	0.2
		1.4	0.8	0.4	0.4	0.1
2.	Inter - 2X	1.3	0.8	0.2	0.1	0
8.		1.4	0.9	0	0.3	0.1
17.		0.9	0.6	0.3	0.1	0.1
		1.2	0.8	0.2	0.2	0.1
4.	Inter - 4X	1.3	0.9	0.6	0	0
11.		0.7	0.6	0.1	0	0
22.		0.9	0.8	0.4	0.2	0.1
		1.0	0.8	0.4	0.1	0
9.	High - 0	1.1	0.8	0.2	0	0.1
16.		1.3	0.8	0.2	0.3	0.1
18.		0.8	0.6	0.2	0	0
		1.1	0.7	0.2	0.1	0.1
3.	High - 2X	0.8	0.8	0.2	0	0
13.		0.8	0.8	0.1	0	0
24.		0.9	0.6	0.2	0.1	0.1
		0.8	0.7	0.2	0	0
6.	High - 4X	1.1	0.9	0.4	0.2	0
15.		1.8	0.9	0.8	0.4	0.2
20.		1.6	0.9	0.5	0.3	0.1
		1.5	0.9	0.6	0.3	0.1
7.	Idle	2.0	0.9	0.4	0.6	0
19.		1.7	0.9	0.4	0.4	0.1
21.		1.7	0.8	0.6	0.5	0.2
		1.8	0.9	0.5	0.5	0.1
26.	Idle-Acceleration	1.3	0.9	0.3	0	0.3
30.		0.7	0.4	0.3	0.1	0
35.		0.7	0.6	0	0.1	0
		0.9	0.6	0.2	0.1	0.1
28.	Acceleration	0.9	0.5	0.3	0.2	0
33.		0.8	0.6	0.3	0	0
37.		0.4	0.3	0.1	0	0
		0.7	0.5	0.2	0.1	0
27.	Deceleration	1.0	0.4	0.6	0.4	0.1
31.		0.8	0.6	0.1	0.1	0
36.		1.0	0.7	0.3	0.1	0.1
		0.9	0.6	0.3	0.2	0.1
29.	Deceleration Relight	0.8	0.6	0.4	0.1	0
32.		0.6	0.6	0.3	0	0
34.		0.7	0.4	0.1	0.1	0
		0.7	0.5	0.3	0.1	0
5.	Hot Start	1.6	0.8	0.3	0.4	0
14.		1.8	0.9	0.6	0.3	0.1
23.		1.2	0.8	0.4	0.2	0.1
		1.5	0.8	0.4	0.3	0.1
1.	Cold Start	3.3	1.1	0.9	0.8	0.4

TABLE C-33. VEHICLE ODOR EVALUATION SUMMARY

Vehicle: Chrysler Gas Turbine
Date: September 25, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
9.	Inter - 0	1.2	0.6	0.3	0.4	0.2
16.		0.9	0.5	0.1	0.2	0.1
20.		1.6	0.9	0.8	0.4	0.1
		1.2	0.7	0.4	0.3	0.1
4.	Inter - 2X	1.5	0.6	0.4	0.5	0.1
14.		1.2	0.8	0.3	0.3	0.1
21.		0.6	0.4	0.1	0.1	0
		1.1	0.6	0.3	0.3	0.1
6.	Inter - 4X	0.9	0.6	0.2	0	0
17.		0.7	0.6	0.2	0.1	0.1
24.		0.8	0.6	0.4	0.5	0
		0.8	0.6	0.3	0.2	0
8.	High - 0	0.8	0.7	0.1	0	0.1
15.		0.9	0.5	0.2	0.4	0
25.		0.8	0.5	0.1	0.1	0.1
		0.8	0.6	0.1	0.2	0.1
2.	High - 2X	1.3	0.9	0.3	0.1	0.1
11.		0.8	0.5	0.1	0	0
19.		0.7	0.8	0.2	0.1	0
		0.9	0.7	0.2	0.1	0
3.	High - 4X	1.2	0.6	0.2	0.5	0
12.		1.1	0.6	0.2	0.3	0.1
22.		0.6	0.4	0.1	0.3	0
		1.0	0.5	0.2	0.4	0
7.	Idle	1.3	0.9	0.2	0.5	0.1
13.		1.4	0.4	0.3	0.5	0.4
18.		1.5	0.8	0.1	0.3	0.4
		1.4	0.7	0.2	0.4	0.3
28.	Idle-Acceleration	0.7	0.4	0.3	0.1	0
33.		0.6	0.6	0.1	0	0
37.		0.6	0.4	0.1	0	0.1
		0.6	0.5	0.2	0	0
26.	Acceleration	0.9	0.5	0.3	0.4	0.1
30.		1.0	0.6	0.2	0.3	0.1
35.		0.6	0.2	0.3	0.1	0
		0.8	0.4	0.3	0.3	0.1
27.	Deceleration	1.1	0.7	0.4	0.2	0
32.		0.7	0.6	0.1	0	0
36.		0.8	0.6	0.1	0	0.1
		0.9	0.6	0.2	0.1	0
29.	Deceleration - Relight	0.6	0.4	0.3	0	0.1
31.		0.5	0.4	0.2	0	0
34.		0.6	0.6	0.1	0	0
		0.6	0.5	0.2	0	0
5.	Hot Start	1.3	0.6	0.4	0	0.3
10.		1.3	0.8	0.2	0.1	0.3
23.		1.1	0.6	0.4	0.5	0
		1.2	0.7	0.3	0.2	0.2
1.	Cold Start	4.1	1.3	1.0	0.9	0.9

Vehicle: Chrysler Gas Turbine
Date: September 27, 1974

Run No.	Operating Condition	"D" Composite	"B" Burnt	"O" Oily	"A" Aromatic	"P" Pungent
2.	Inter - 0	1.8	0.6	0.5	0.6	0.2
15.		1.3	1.0	0.4	0	0.3
17.		0.9	0.9	0.2	0.1	0
		1.3	0.8	0.4	0.2	0.2
10.	Inter - 2X	1.4	0.8	0.4	0.4	0
19.		1.1	0.6	0.4	0.5	0.1
25.		0.9	0.6	0.3	0.3	0.1
		1.1	0.7	0.4	0.4	0.1
5.	Inter - 4X	1.4	0.6	0.4	0.4	0
16.		1.6	0.9	0.4	0.4	0.4
23.		1.2	0.6	0.3	0.4	0.1
		1.4	0.7	0.4	0.4	0.2
9.	High - 0	1.3	0.9	0.5	0.3	0.1
11.		0.9	0.4	0.4	0.4	0
18.		1.2	0.6	0.4	0.5	0.1
		1.1	0.6	0.4	0.4	0.1
3.	High - 2X	1.4	0.6	0.3	0.4	0.2
14.		1.0	0.8	0.2	0.1	0.2
		1.5	0.7	0.4	0.4	0.2
		1.3	0.7	0.3	0.3	0.2
7.	High - 4X	1.1	0.8	0.4	0.1	0
12.		1.1	0.8	0.1	0	0
21.		1.1	0.7	0.3	0.1	0.3
		1.1	0.8	0.3	0.1	0.1
6.	Idle	1.4	0.4	0.5	0.5	0
8.		1.3	0.6	0.6	0.2	0.1
20.		1.4	0.9	0.2	0.5	0.1
		1.4	0.6	0.4	0.4	0.1
27.	Idle-Acceleration	1.2	0.5	0.2	0.6	0
30.		1.2	0.6	0.1	0.3	0.2
35.		0.7	0.4	0.1	0.3	0
		1.0	0.5	0.1	0.4	0.1
28.	Acceleration	1.4	0.6	0.3	0.3	0.4
32.		1.1	0.6	0.4	0.3	0
37.		0.5	0.4	0	0	0
		1.0	0.5	0.2	0.2	0.1
29.	Deceleration	1.5	0.7	0.5	0.3	0.2
33.		0.4	0.4	0	0.1	0
36.		0.9	0.5	0.1	0.2	0.1
		0.9	0.5	0.2	0.2	0.1
26.	Deceleration - Relight	0.8	0.3	0.1	0.4	0
31.		1.8	0.9	0.4	0.1	0.4
34.		0.4	0.3	0	0	0
		1.0	0.5	0.2	0.2	0.1
4.	Hot Start	1.3	0.6	0.1	0.5	0.1
13.		1.3	0.8	0.4	0.2	0.1
22.		1.3	0.5	0.4	0.3	0.1
		1.3	0.6	0.3	0.3	0.1
1.	Cold Start	3.6	1.0	0.9	0.7	1.0

APPENDIX D

INSTRUMENTAL-WET CHEMICAL EXHAUST DATA TAKEN DURING ODOR TESTS

TABLE D-1. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--NISSAN-DATSUN EVALUATION

					NDIR	CL						Aliphatic	DOAS Results		
Condition	Load	Date	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aldehydes, ppm	LCA, µg/l	LCO, µg/l	TIA
1800 rpm	0	1/8/74 W	68	264	57	78	97	16.8	2.7	1.1	5.0	11.0	7	3.5	1.5
		1/10/74 S	83	271	66	75	96	17.1	2.3	2.3	5.2	9.1	4	2.8	1.4
1800 rpm 24 mph	1/2	1/8/74 W	103	173	365	332	344	10.8	7.5	0.8	3.5	11.0	9	3.7	1.6
		1/10/74 S	67	168	333	307	317	11.2	6.8	1.8	5.0	11.8	6	3.4	1.5
1800 rpm 24 mph	Full	1/8/74 W	115	2792	384	380	380	1.3	14.4	1.0	3.7	9.4	17	4.8	1.7
		1/10/74 S	107	536	417	400	400	2.6	13.7	1.8	4.6	7.7	11	4.3	1.6
3000 rpm	0	1/8/74 W	60	326	129	138	153	15.7	3.2	0.8	4.2	12.9	26	6.9	1.8
		1/10/74 S	75	304	134	136	142	16.0	3.2	2.3	5.8	7.7	17	5.8	1.8
3000 rpm 40 mph	1/2	1/8/74 W	52	133	425	427	427	10.0	8.1	0.4	2.9	8.3	11	3.7	1.6
		1/10/74 S	33	135	407	400	402	9.9	7.5	1.7	5.0	9.6	5	3.5	1.5
3000 rpm 40 mph	Full	1/8/74 W	481	11555	398	378	382	0.4	14.5	0.3	3.3	10.5	14	5.0	1.7
		1/10/74 S	125	2261	428	423	423	1.5	14.0	1.7	3.3	6.3	9	3.9	1.6
Idle		1/8/74 W	59	169	96	97	126	16.6	2.5	0.9	4.0	11.8	42	5.2	1.7
		1/10/74 S	39	151	84	96	104	17.1	2.3	1.9	4.4	8.3	24	8.9	1.9

W - Winter Switch
S - Summer Switch

TABLE D-2. GASEOUS EMISSIONS SUMMARY

Vehicle: Nissan - Datsun Diesel - Winter Switch

Date: January 8, 1974

Run No.	Operating Condition[a]	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
2.	Inter - 0	40	252	72	99	105	16.3	2.4	2.1	6.2	10.7	7	3.2	1.5
15.		68	243	57	75	91	17.0	2.5	0.8	4.4	13.2	11	4.4	1.6
18.		96	298	43	59	94	17.0	3.1	0.2	4.4	9.1	8	3.6	1.6
		68	264	57	78	97	16.8	2.7	1.1	5.0	11.0	9	3.7	1.6
6.	Inter - 50	96	137	341	35	37	10.8	7.6	0.3	3.1	9.9	7	3.4	1.5
9.		80	156	365	34	34	10.8	7.6	1.7	4.4	12.4	19	4.5	1.7
11.		132	226	389	31	33	10.8	7.4	0.5	3.1	11.0	27	6.4	1.8
		103	173	365	33	34	10.8	7.5	0.8	3.5	11.0	18	4.8	1.7
3.	Inter - 100	120	1722	389	390	390	1.5	13.6	0.5	2.5	8.3	25	6.2	1.8
14.		104	2197	377	375	375	1.0	15.0	1.4	3.7	8.3	24	6.3	1.8
16.		120	2261	385	375	375	1.3	14.7	1.1	5.0	11.6	30	8.2	1.8
		115	2090	384	380	380	1.3	14.4	1.0	3.7	9.4	26	6.9	1.8
5.	High - 0	52	317	127	137	162	15.8	3.2	1.0	3.7	12.4	10	3.4	1.5
10.		72	345	154	135	145	15.8	3.2	0.7	5.0	12.4	8	3.3	1.5
17.		56	317	105	142	152	15.5	3.3	0.8	3.7	14.0	13	4.4	1.6
		60	326	129	138	153	15.7	3.2	0.8	4.2	12.9	10	3.7	1.5
4.	High - 50	32	122	422	445	445	10.0	7.9	0.1	2.5	8.3	7	3.4	1.5
13.		68	156	431	415	415	10.0	8.1	0.3	3.1	7.4	25	7.7	1.9
19.		57	122	422	420	420	10.0	8.2	0.9	3.1	9.1	11	3.8	1.6
		52	133	425	427	427	10.0	8.1	0.4	2.9	8.3	14	5.0	1.7
1.	High - 100	400	11500	381	410	410	0.3	14.1	0.3	1.9	9.1	22	3.4	1.5
7.		504	10125	398	390	400	0.5	14.7	0.2	3.7	9.9	54	7.0	1.8
21.		540	13039	414	335	335	0.3	14.7	0.5	4.4	12.4	49	5.3	1.7
		481	11555	398	378	382	0.4	14.5	0.3	3.3	10.5	42	5.2	1.7
8.	Idle	40	147	116	116	148	16.0	2.7	0.9	6.2	14.0	8	4.0	1.6
12.		72	199	101	80	110	16.8	2.3	1.2	3.1	13.2	9	4.1	1.6
20.		64	160	72	95	120	17.0	2.4	0.6	2.5	8.3	4	2.5	1.4
		59	169	96	97	126	16.6	2.5	0.9	4.0	11.8	7	3.5	1.5

TABLE D-3. GASEOUS EMISSIONS SUMMARY

Vehicle: Nissan - Datsun Diesel - Summer Switch

Date: January 10, 1974

				NDIR	CL								DOAS Results		
Run No.	Operating Condition	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, µg/l	LCO, µg/l	TIA
6.	Inter - 0	96	298	83	60	95	17.3	2.3	2.6	5.0	9.1	8	3.8	1.6
14.		80	262	21	65	87	17.3	2.4	2.3	5.6	10.7	5	3.0	1.5
16.		72	252	94	100	105	16.8	2.2	2.0	5.0	7.4	6	3.6	1.6
		83	271	66	75	96	17.1	2.3	2.3	5.2	9.1	6	3.5	1.6
5.	Inter - 50	72	164	309	300	315	12.0	6.5	1.9	5.6	12.4	12	3.9	1.6
10.		64	176	349	305	310	10.8	7.0	1.8	4.4	12.4	10	4.2	1.6
21.		64	164	341	315	325	10.8	7.0	1.8	5.0	10.7	13	4.8	1.7
		67	168	333	307	317	11.2	6.8	1.8	5.0	11.8	12	4.3	1.6
4.	Inter - 100	96	570	398	400	400	3.3	13.3	1.7	4.4	9.9	15	5.2	1.7
11.		120	597	431	410	410	2.0	14.0	1.8	5.0	11.6	16	5.7	1.8
19.		104	442	422	390	390	2.5	13.7	1.8	4.4	6.6	19	6.5	1.8
		107	536	417	400	400	2.6	13.7	1.8	4.6	7.7	17	5.8	1.8
2.	High - 0	56	298	109	133	141	17.3	3.1	2.1	5.0	9.1	4	2.9	1.5
12.		80	317	154	125	135	15.3	3.2	2.4	6.2	6.7	6	3.2	1.5
20.		88	298	138	150	150	15.3	3.2	2.4	6.2	7.4	6	3.0	1.5
		75	304	134	136	142	16.0	3.2	2.3	5.8	7.7	5	3.0	1.5
8.	High - 50	24	126	389	400	405	10.0	7.9	1.7	4.4	12.4	9	4.5	1.7
13.		44	139	406	400	400	9.8	6.9	1.9	5.6	8.3	8	3.6	1.6
17.		32	139	427	400	400	9.8	7.8	1.5	5.0	8.3	8	3.7	1.6
		33	135	407	400	402	9.9	7.5	1.7	5.0	9.6	8	3.9	1.6
1.	High - 100	120	2261	451	425	425	2.0	14.2	1.7	3.1	6.6	11	3.9	1.6
7.		120	2261	410	425	425	1.3	13.3	1.5	3.7	7.4	34	11.4	2.1
15.		136	2261	422	418	418	1.3	14.4	1.8	3.1	9.9	26	11.4	2.1
		125	2261	428	423	423	1.5	14.0	1.7	3.3	6.3	24	8.9	1.9
3.	Idle	44	147	79	90	100	18.3	2.2	1.8	4.4	7.4	4	2.6	1.4
9.		40	156	64	92	103	16.5	2.3	2.0	5.0	7.4	5	3.0	1.5
18.		32	151	109	105	110	16.5	2.4	1.8	3.7	9.9	2	2.8	1.4
		39	151	84	96	104	17.1	2.3	1.9	4.4	8.3	4	2.8	1.4

TABLE D-4. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--MERCEDES 220D EVALUATION

Condition	Load	Date	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, μg/l	DOAS Results LCO, μg/l	DOAS Results TIA
1830 rpm	0	1/15/74	75	226	63	74	80	16.3	2.8	1.0	2.9	11.0	13	4.3	1.6
		1/17/74	77	227	68	76	85	16.4	2.8	0.7	1.9	8.2	10	3.8	1.6
		Average	76	227	66	75	83	16.4	2.8	0.9	2.4	9.6	12	4.1	1.6
1830 rpm 33 mph	1/2	1/15/74	80	248	353	338	342	11.3	6.8	0.8	2.9	11.8	13	4.1	1.6
		1/17/74	73	248	327	328	333	10.9	7.1	0.5	3.8	9.1	13	4.0	1.5
		Average	77	248	340	333	338	11.1	7.0	0.7	3.4	10.5	13	4.1	1.6
1830 rpm 33 mph	Full	1/15/74	83	257	435	420	428	6.4	10.7	0.4	3.9	11.0	16	6.0	1.7
		1/17/74	79	344	440	403	405	6.2	11.0	0.9	4.4	7.7	10	3.9	1.6
		Average	81	301	438	412	417	6.3	10.9	0.7	4.2	9.4	13	5.0	1.7
3050 rpm	0	1/15/74	55	358	96	105	110	15.4	3.4	1.1	3.7	11.8	10	4.2	1.6
		1/17/74	59	366	98	100	105	15.5	3.5	0.6	3.7	11.8	10	3.5	1.5
		Average	57	362	97	103	108	15.5	3.5	0.9	3.7	11.8	10	3.9	1.6
3050 rpm 56 mph	1/2	1/15/74	49	244	414	403	408	10.4	7.6	0.4	4.6	11.8	9	4.1	1.6
		1/17/74	60	259	409	372	373	10.2	7.9	1.0	4.2	10.7	11	3.4	1.5
		Average	55	252	412	388	391	10.3	7.8	0.7	4.4	11.3	10	3.8	1.6
3050 rpm 56 mph	Full	1/15/74	85	262	570	553	553	5.2	11.4	0.8	5.0	9.1	26	8.8	1.9
		1/17/74	99	284	559	515	515	4.9	12.0	0.8	3.3	10.5	22	7.4	1.8
		Average	92	273	565	534	534	5.1	11.7	0.8	4.2	9.8	24	8.1	1.9
Idle		1/15/74	123	236	111	110	117	16.0	2.9	1.1	3.5	12.4	14	4.0	1.6
		1/17/74	109	271	86	103	103	16.3	2.9	0.7	1.9	8.2	11	3.2	1.5
		Average	116	254	99	107	110	16.2	2.9	0.9	2.7	10.3	13	3.6	1.6

TABLE D-5. GASEOUS EMISSIONS SUMMARY

Vehicle: Mercedes 220D

Date: January 15, 1974

					CL							DOAS Results		
Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, μg/l	LCO, μg/l	TIA
2.	Inter - 0	76	235	69	73	85	17.0	3.1	1.0	2.5	13.2	9	3.3	1.5
10.		72	213	58	84	87	16.3	2.6	0.7	3.1	10.7	12	4.4	1.6
20.		76	231	61	65	68	15.8	2.7	1.2	3.1	9.1	18	5.2	1.7
		75	226	63	74	80	16.3	2.8	1.0	2.9	11.0	13	4.3	1.6
1.	Inter - 50	64	252	309	320	320	11.8	6.3	0.7	1.9	13.2	12	3.2	1.5
8.		80	235	357	340	350	11.3	7.0	0.7	2.5	9.1	10	4.0	1.6
18.		96	257	394	355	355	10.8	7.0	0.9	4.4	13.2	18	5.1	1.7
		80	248	353	338	342	11.3	6.8	0.8	2.9	11.8	13	4.1	1.6
9.	Inter - 100	80	267	427	410	415	6.5	10.6	0.3	5.0	13.2	18	6.6	1.8
11.		80	253	431	410	420	6.5	10.6	0.3	3.7	10.7	18	6.6	1.8
15.		88	252	448	440	450	6.3	10.8	0.5	3.1	9.1	12	4.7	1.6
		83	257	435	420	428	6.4	10.7	0.4	3.9	11.0	16	6.0	1.7
6.	High - 0	52	345	102	101	116	15.3	3.4	1.0	4.4	13.2	10	4.2	1.6
14.		56	355	94	94	115	16.0	3.4	1.1	3.1	11.6	8	4.1	1.6
19.		56	374	91	91	100	15.0	3.3	1.1	3.7	10.7	14	4.4	1.6
		55	358	96	96	105	15.4	3.4	1.1	3.7	11.8	10	4.2	1.6
5.	High - 50	56	262	411	390	400	10.5	7.3	0.5	4.4	10.7	12	5.0	1.7
7.		44	226	419	425	430	10.3	8.0	0.5	5.0	13.2	9	4.0	1.6
16.		48	244	411	395	395	10.3	7.6	0.3	4.4	11.6	6	3.2	1.5
		49	244	414	403	408	10.4	7.6	0.4	4.6	11.8	9	4.1	1.6
3.	High - 100	88	280	576	555	555	5.3	11.2	0.8	4.4	9.1	30	9.2	2.0
		80	253	585	560	560	5.2	11.7	0.9	5.6	9.1	18	7.8	1.8
		88	253	550	550	545	5.0	11.3	0.8	5.0	9.1	31	9.5	2.0
		85	262	570	553	553	5.2	11.4	0.8	5.0	9.1	26	8.8	1.9
4.	Idle	104	235	117	105	116	16.3	2.9	1.1	3.7	13.2	14	4.3	1.6
12.		128	226	102	110	115	15.8	2.8	1.2	2.5	13.2	14	3.8	1.6
17.		138	248	102	115	120	15.9	3.1	1.1	4.4	10.7	14	3.8	1.6
		123	236	111	110	117	16.0	2.9	1.1	3.5	12.4	14	4.0	1.6

TABLE D-6. GASEOUS EMISSIONS SUMMARY

Vehicle: Mercedes 220D

Date: January 17, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL		O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results		
					NO, ppm	NO$_x$, ppm						LCA, µg/l	LCO, µg/l	TIA
4.	Inter - 0	80	235	65	75	93	16.5	2.7	1.0	3.1	8.3	13	4.4	1.6
10.		80	222	80	80	83	16.3	2.9	0.7	3.1	5.8	8	3.2	1.5
12.		72	224	58	72	80	16.5	2.7	1.1	3.1	5.8	10	3.8	1.6
		77	227	68	76	85	16.4	2.8	0.9	3.1	6.6	10	3.8	1.6
2.	Inter - 50	84	257	309	320	320	11.0	6.8	0.3	5.0	9.1	18	4.4	1.6
8.		64	253	353	340	350	10.8	7.3	0.6	3.7	9.9	7	3.1	1.4
11.		72	235	321	325	330	11.0	7.1	0.5	2.5	8.3	14	4.6	1.6
		73	248	328	328	333	10.9	7.1	0.5	3.7	9.1	13	4.0	1.5
9.	Inter - 100	80	336	423	395	400	6.3	11.3	0.9	5.0	9.9	13	4.6	1.6
17.		80	345	448	410	410	6.0	10.8	0.9	5.0	5.8	8	3.2	1.5
21.		76	350	448	405	405	6.3	10.8	0.9	3.1	7.4	9	3.9	1.6
		79	344	440	403	405	6.2	11.0	0.9	4.4	7.7	10	3.9	1.6
3.	High - 0	60	364	98	95	105	15.3	3.5	0.9	3.7	11.5	13	4.1	1.6
6.		60	360	94	100	105	15.8	3.5	0.3	3.7	9.1	8	3.2	1.5
20.		56	374	102	105	105	15.5	3.5	0.6	3.7	14.9	8	3.2	1.5
		59	366	98	100	105	15.5	3.5	0.6	3.7	11.8	10	3.5	1.5
7.	High - 50	56	253	382	370	370	10.3	8.1	1.0	5.0	9.9	7	3.1	1.4
15.		64	262	422	380	380	10.3	7.7	0.9	3.7	10.7	10	4.0	1.6
16.		60	262	422	365	370	10.0	8.0	1.0	3.7	11.6	16	3.2	1.5
		60	259	409	372	373	10.2	7.9	1.0	4.2	10.7	11	3.4	1.5
5.	High - 100	80	299	524	520	520	5.0	12.3	0.3	3.7	9.1	30	10.0	2.0
13.		120	253	559	505	505	5.0	11.8	0.9	2.5	12.4	23	7.5	1.8
19.		96	299	593	520	520	4.8	11.9	1.1	3.7	9.9	14	4.8	1.6
		99	284	559	515	515	4.9	12.0	0.8	3.3	10.5	22	7.4	1.8
1.	Idle	96	271	76	100	100	16.5	2.8	0.7	1.8	8.3	14	3.3	1.5
14.		112	270	87	100	100	16.3	3.0	0.7	1.9	9.1	11	4.0	1.6
18.		120	271	94	110	110	16.0	3.0	0.8	1.9	7.4	8	2.5	1.4
		109	271	86	103	103	16.3	2.9	0.7	1.9	8.2	11	3.2	1.5

TABLE D-7. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--PEUGEOT 504D EVALUATION

Condition	Load	Date	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
1800 rpm	0	3/5/74	1040	830	18	18	43	17.5	2.4	11.2	10.0	34.9	120	13.9	2.1
		3/7/74	968	692	49	45	63	17.2	2.6	11.2	11.0	37.1	148	18.0	2.2
		Average	1004	761	34	32	53	17.4	2.5	11.2	10.5	36.0	134	16.0	2.2
1800 rpm 32 mph	1/2	3/5/74	336	241	210	168	189	11.8	7.0	2.7	8.5	17.3	119	13.3	2.1
		3/7/74	341	233	231	219	226	11.0	7.4	3.0	12.9	18.2	105	12.1	2.1
		Average	339	237	221	194	208	11.4	7.2	2.9	10.7	17.8	112	12.7	2.1
1800 rpm 32 mph	Full	3/5/74	392	752	263	238	238	4.5	12.3	1.7	13.1	16.1	97	12.0	2.0
		3/7/74	390	619	235	258	258	4.2	12.6	2.2	13.5	24.2	158	19.3	2.2
		Average	391	686	249	248	248	4.4	12.5	2.0	13.3	20.2	128	15.7	2.1
3000 rpm	0	3/5/74	944	479	60	52	70	16.5	3.1	5.9	11.4	26.1	143	12.1	2.1
		3/7/74	959	452	52	54	82	16.8	2.9	4.1	12.3	23.4	163	14.9	2.1
		Average	952	466	56	53	76	16.7	3.0	5.0	11.9	24.8	153	13.5	2.1
3000 rpm 56 rpm	1/2	3/5/74	504	550	247	223	238	10.5	7.9	6.1	16.2	19.4	92	11.6	2.1
		3/7/74	320	548	246	380	385	10.5	8.2	4.6	14.5	20.6	119	15.5	2.1
		Average	412	549	247	302	312	10.5	8.1	5.4	15.4	20.0	106	13.6	2.1
3000 rpm 56 mph	Full	3/5/74	536	949	321	283	283	3.6	12.9	2.9	10.2	18.7	189	25.6	2.4
		3/7/74	588	1249	308	324	328	3.2	13.3	2.3	9.8	20.6	198	29.4	2.5
		Average	562	1099	315	304	306	3.4	13.1	2.6	10.0	19.7	194	27.5	2.5
Idle		3/5/74	388	629	60	74	76	17.6	2.3	6.1	11.4	28.0	59	8.9	1.9
		3/7/74	276	555	66	67	86	17.2	3.5	7.3	17.4	37.1	66	10.6	2.0
		Average	332	592	63	71	81	17.4	2.9	6.7	14.4	32.6	63	9.8	2.0

TABLE D-8. GASEOUS EMISSIONS SUMMARY

Vehicle: Peugeot 504D

Date: March 5, 1974

				NDIR	CL						Aliphatic	DOAS Results		
Run No.	Operating Condition	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aldehydes, ppm	LCA, µg/l	LCO, µg/l	TIA
2.	Inter - 0	1040	788	29	16	45	18.3	2.4	12.0	8.7	34.6	133	14.5	2.2
10.		1040	709	14	27	45	17.5	2.4	9.7	11.2	33.0	137	14.1	2.1
20.		-	992	11	11	40	16.8	2.5	11.9	10.0	37.1	90	13.0	2.1
		1040	830	18	18	43	17.5	2.4	11.2	10.0	34.9	120	13.9	2.1
1.	Inter - 50	320	253	219	172	189	12.0	7.0	2.6	8.1	16.5	69	8.7	1.9
8.		320	244	196	159	180	12.0	6.8	2.7	7.5	18.2	85	10.0	2.0
18.		368	226	215	174	197	11.3	7.0	2.7	10.0	17.3	202	21.1	2.3
		336	241	210	168	189	11.8	7.0	2.7	8.5	17.3	119	13.3	2.1
9.	Inter - 100	312	794	270	228	228	4.5	12.3	1.6	11.2	14.9	28	5.9	1.8
11.		512	709	270	250	250	5.0	12.0	2.0	15.0	17.3	151	17.2	2.2
15.		352	-	249	235	235	4.0	12.7	1.5	-	-	112	12.9	2.1
		392	752	263	238	238	4.5	12.3	1.7	13.1	16.1	97	12.0	2.0
6.	High - 0	984	498	58	40	67	17.3	2.9	7.9	10.6	24.7	157	12.8	2.1
14.		848	427	72	80	-	16.3	3.3	4.3	13.1	26.4	185	14.5	2.2
19.		1000	513	50	37	72	16.0	3.0	5.4	10.6	27.2	87	9.0	2.0
		944	479	60	52	70	16.5	3.1	5.9	11.4	26.1	143	12.1	2.1
5.	High - 50	688	627	272	205	225	10.5	8.0	7.1	16.2	22.3	64	9.6	2.0
7.		472	555	211	200	215	11.0	7.7	5.3	15.0	16.5	108	12.0	2.1
16.		352	467	257	265	275	10.0	8.1	5.8	17.4	-	103	13.3	2.1
		504	550	247	223	238	10.5	7.9	6.1	16.2	19.4	92	11.6	2.1
3.	High - 100	640	1068	327	280	280	3.8	12.9	2.9	8.1	18.2	160	22.4	2.4
13.		432	896	309	270	270	3.5	12.9	2.4	13.1	18.2	130	19.9	2.3
		-	882	327	300	300	3.5	12.9	3.5	9.4	19.8	277	34.6	2.5
		536	949	321	283	283	3.6	12.9	2.9	10.2	18.7	189	25.6	2.4
4.	Idle	320	619	80	77	78	18.0	2.3	5.0	9.4	24.7	57	8.8	1.9
12.		348	544	65	70	76	17.6	2.3	6.1	14.3	31.3	58	8.2	1.9
17.		496	724	36	75	75	17.3	2.4	7.2	10.6	28.0	62	9.6	2.0
		388	629	60	74	76	17.6	2.3	6.1	11.4	28.0	59	8.9	1.9

TABLE D-9. GASEOUS EMISSIONS SUMMARY

Vehicle: Peugeot 504D

Date: March 7, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
3.	Inter - 0	-	-	-	-	-	-	-	10.9	10.0	33.0	148	17.6	2.2
19.		944	707	25	20	51	17.3	2.5	12.1	10.6	35.5	126	16.2	2.2
21.		992	676	72	70	75	17.0	2.6	10.5	12.5	42.9	170	20.2	2.3
		968	692	49	45	63	17.2	2.6	11.2	11.0	37.1	148	18.0	2.2
8.	Inter - 50	430	285	192	215	225	10.8	7.6	2.9	13.1	17.3	109	10.7	2.0
11.		272	213	254	230	230	10.8	7.2	3.5	13.7	19.0	131	13.4	2.1
17.		272	200	246	212	224	11.5	7.3	2.6	11.8	18.2	74	12.3	2.1
		341	233	231	219	226	11.0	7.4	3.0	12.9	18.2	105	12.1	2.1
1.	Inter - 100	-	-	-	-	-	-	-	2.0	12.5	20.6	153	21.2	2.3
10.		560	619	285	265	265	5.0	11.8	2.1	13.1	23.1	198	19.1	2.2
14.		220	-	184	250	250	3.4	13.3	2.4	15.0	28.9	122	17.6	2.2
		390	619	235	258	258	4.2	12.6	2.2	13.5	24.2	158	19.3	2.2
5.	High - 0	-	-	-	-	-	-	-	4.4	12.5	22.3	192	18.1	2.2
7.		768	441	39	56	85	17.0	3.0	3.4	14.3	24.7	118	11.1	2.0
9.		1150	462	65	51	78	16.5	2.8	4.5	10.0	23.1	179	15.4	2.2
		959	452	52	54	82	16.8	2.9	4.1	12.3	23.4	163	14.9	2.1
2.	High - 50	-	-	-	-	-	-	-	4.8	16.2	21.4	50	6.7	1.8
4.		-	-	-	-	-	-	-	4.6	15.0	18.2	202	27.0	2.4
15.		320	548	246	380	385	10.5	8.2	4.4	12.5	22.3	106	12.7	2.1
		320	548	246	380	385	10.5	8.2	4.6	14.5	20.6	119	15.5	2.1
6.	High - 100	-	-	-	-	-	-	-	3.2	8.7	16.5	210	29.4	2.4
12.		392	1311	270	318	325	3.0	13.3	3.3	10.0	24.7	170	22.2	2.4
20.		784	1187	345	330	330	3.4	13.2	3.4	10.6	20.6	214	36.5	2.6
		588	1249	308	324	328	3.2	13.3	3.3	9.8	20.6	198	29.4	2.5
13.	Idle	276	534	102	85	90	16.3	2.4	6.7	15.6	33.0	103	12.1	2.1
16.		320	597	36	65	82	17.8	5.8	7.3	19.3	37.1	53	7.4	1.9
18.		232	533	61	52	85	17.5	2.4	7.8	17.4	41.2	42	12.2	2.1
		276	555	66	67	86	17.2	3.5	7.3	17.4	37.1	66	10.6	2.0

TABLE D-10. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--OPEL REKORD EVALUATION

Condition	Load	Date	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
1950 rpm	0	3/19/74	109	254	49	86	109	15.2	2.6	2.4	3.3	9.1	16	5.8	1.7
		3/21/74	78	237	68	102	121	16.0	2.7	3.0	4.2	12.1	7	4.4	1.7
		Average	94	246	59	94	115	15.6	2.7	2.7	3.8	10.6	12	5.1	1.7
2300 rpm	1/2	3/19/74	123	170	256	273	280	8.3	8.6	1.5	3.1	6.3	35	8.6	1.9
		3/21/74	104	153	319	293	300	9.1	8.2	1.4	3.5	8.8	15	5.6	1.8
		Average	114	162	288	283	290	8.7	8.4	1.5	3.3	7.6	25	7.1	1.9
2550 rpm	Full	3/19/74	128	691	280	295	296	2.8	13.4	0.8	2.5	6.2	22	8.4	1.9
		3/21/74	152	390	306	317	323	3.5	12.9	1.1	4.6	9.4	18	7.4	1.9
		Average	140	541	293	306	310	3.2	13.2	1.0	3.6	7.8	20	7.9	1.9
3250 rpm	0	3/19/74	107	368	72	102	120	14.4	3.4	2.7	3.3	8.6	10	5.8	1.8
		3/21/74	89	355	97	110	135	15.4	3.3	3.5	3.7	11.3	9	7.8	1.7
		Average	98	362	85	106	128	14.9	3.4	3.1	3.5	10.0	10	6.8	1.8
3360 rpm	1/2	3/19/74	164	224	330	323	332	8.6	8.4	2.5	3.5	8.3	66	13.9	2.1
		3/21/74	179	259	372	349	355	9.3	8.0	1.7	3.5	9.4	33	8.9	1.9
		Average	172	242	351	336	344	9.0	8.2	2.1	3.5	8.9	50	11.4	2.0
3460 rpm	Full	3/19/74	127	1322	321	328	328	2.0	13.9	1.1	2.9	6.4	49	16.7	2.1
		3/21/74	132	627	343	348	352	2.5	13.6	0.8	5.6	8.8	24	9.3	2.0
		Average	130	975	332	338	340	2.3	13.8	1.0	4.3	7.6	37	13.0	2.1
Idle		3/19/74	84	204	35	93	93	15.4	2.6	1.4	3.3	8.2	19	5.7	1.8
		3/21/74	53	170	55	92	103	16.3	2.6	2.0	2.9	7.4	7	3.9	1.6
		Average	69	187	45	93	98	15.9	2.6	1.7	3.1	7.8	13	4.8	1.7

TABLE D-11. GASEOUS EMISSIONS SUMMARY

Vehicle: Opel Rekord

Date: March 19, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, μg/l	DOAS Results LCO, μg/l	DOAS Results TIA
2.	Inter - 0	104	244	36	85	110	16.3	2.6	2.1	3.7	8.3	27	6.8	1.8
10.		108	248	47	92	107	15.0	2.6	1.2	1.2	7.4	11	5.2	1.7
20.		116	271	65	80	110	14.3	2.7	3.9	5.0	11.6	9	5.3	1.7
		109	254	49	86	109	15.2	2.6	2.4	3.3	9.1	16	5.8	1.7
1.	Inter - 1/2	108	173	247	295	295	9.0	8.4	2.0	2.5	5.0	64	10.3	2.0
8.		116	165	272	265	280	8.3	8.6	1.5	3.7	6.6	16	6.0	1.8
18.		144	173	249	260	265	7.8	8.7	1.1	3.1	7.4	25	9.5	2.0
		123	170	256	273	280	8.3	8.6	1.5	3.1	6.3	35	8.6	1.9
9.	Inter - Full	132	652	280	300	300	3.0	12.9	0.7	2.5	6.6	26	7.5	1.9
11.		112	-	272	295	295	2.5	14.2	-	-	-	20	8.5	1.9
15.		140	730	288	290	293	3.0	13.0	0.9	2.5	5.8	19	9.2	2.0
		128	691	280	295	296	2.8	13.4	0.8	2.5	6.2	22	8.4	1.9
6.	High - 0	88	384	80	96	131	15.3	3.4	3.4	3.7	8.3	10	5.1	1.7
14.		116	355	65	120	125	14.5	3.4	2.7	3.1	9.1	13	6.1	1.8
19.		116	364	71	90	115	13.5	3.4	2.0	3.1	8.3	8	6.1	1.8
		107	368	72	102	120	14.4	3.4	2.7	3.3	8.6	10	5.8	1.8
5.	High - 1/2	112	191	360	340	350	8.8	8.6	0.9	3.1	6.6	28	10.9	2.0
7.		216	299	351	330	340	8.5	8.5	1.5	4.4	8.3	49	10.9	2.0
16.		-	182	280	300	305	8.5	8.2	5.2	3.1	9.9	122	20.0	2.3
		164	224	330	323	332	8.6	8.4	2.5	3.5	8.3	66	13.9	2.1
3.	High - Full	112	1311	333	345	345	2.0	13.9	1.1	3.1	5.0	114	17.5	2.2
13.		128	946	295	320	320	2.3	13.9	0.8	2.5	5.8	16	7.2	1.9
21.		140	1333	335	320	320	1.8	13.9	1.4	3.1	8.3	18	11.5	2.1
		127	1322	321	328	328	2.0	13.9	1.1	2.9	6.4	49	16.7	2.1
4.	Idle	60	257	69	95	95	15.8	2.6	0.8	3.7	7.4	33	7.3	1.9
12.		80	173	0	90	90	16.0	2.5	0.7	3.1	7.4	9	4.0	1.6
17.		112	182	36	95	95	14.5	2.6	2.8	3.1	9.9	14	5.9	1.8
		84	204	35	93	93	15.4	2.6	1.4	3.3	8.2	19	5.7	1.8

TABLE D-12. GASEOUS EMISSIONS SUMMARY

Vehicle: Opel Rekord

Date: March 21, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
2.	Inter - 0	64	231	64	115	115	16.3	2.6	3.0	4.4	11.6	7	4.6	1.7
14.		83	235	76	85	115	15.8	2.6	3.3	2.5	11.6	7	3.9	1.6
18.		88	244	65	105	132	15.8	2.9	2.7	5.6	13.2	8	4.7	1.7
		78	237	68	102	121	16.0	2.7	3.0	4.2	12.1	7	4.4	1.7
3.	Inter - 1/2	80	156	319	305	305	9.3	8.1	1.5	3.1	9.1	9	4.5	1.7
9.		96	156	327	280	290	9.3	7.9	1.6	3.7	9.9	14	5.8	1.8
20.		136	148	311	295	305	8.8	8.5	1.2	3.7	7.4	22	6.5	1.8
		104	153	319	293	300	9.1	8.2	1.4	3.5	8.8	15	5.6	1.8
7.	Inter - Full	192	355	264	310	315	3.5	12.9	1.2	2.5	9.1	23	8.3	1.9
12.		132	374	327	322	330	3.5	13.2	1.2	4.4	9.9	15	7.1	1.9
16.		132	442	327	320	325	3.5	12.6	0.8	6.9	9.1	15	6.8	1.8
		152	390	306	317	323	3.5	12.9	1.1	4.6	9.4	18	7.4	1.9
4.	High - 0	80	341	100	105	135	15.3	3.3	3.5	2.5	9.1	5	4.3	1.6
8.		96	336	92	112	130	15.3	3.3	3.8	5.6	12.4	14	6.5	1.8
11.		92	389	100	112	140	15.8	3.4	3.2	3.1	12.4	7	5.1	1.7
		89	355	97	110	135	15.4	3.3	3.5	3.7	11.3	9	7.8	1.7
5.	High - 1/2	88	169	391	345	355	9.0	8.3	1.6	2.5	9.1	17	6.7	1.8
15.		128	200	375	358	365	9.3	8.0	1.5	2.5	9.9	26	7.4	1.9
17.		320	408	351	345	345	9.5	7.8	2.0	5.6	9.1	57	12.7	2.1
		179	259	372	349	355	9.3	8.0	1.7	3.5	9.4	33	8.9	1.9
1.	High - Full	132	663	360	370	370	2.5	13.5	0.7	8.7	9.1	28	9.9	2.0
10.		120	555	359	345	345	2.8	13.3	0.7	5.0	8.3	21	9.0	2.0
21.		144	663	311	330	340	2.3	13.9	1.1	3.1	9.1	23	8.9	1.9
		132	627	343	348	352	2.5	13.6	0.8	5.6	8.8	24	9.3	2.0
6.	Idle	74	173	36	75	95	16.5	2.5	2.5	2.5	5.0	7	3.9	1.6
13.		68	165	80	110	110	16.3	2.6	1.1	3.1	9.9	7	3.5	1.5
19.		92	173	50	90	105	16.0	2.7	2.3	3.1	7.4	7	4.3	1.6
		53	170	55	92	103	16.3	2.6	2.0	2.9	7.4	7	3.9	1.6

TABLE D-13. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--FORD LTD EVALUATION

					NDIR	CL							DOAS Results		
Condition	Load	Date	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, µg/l	LCO, µg/l	TIA
1200 rpm	0	4/12/74	315	108	114	95	102	7.1	10.2	0.9	2.9	13.5	5	5.3	1.7
		4/30/74	272	333	88	95	95	7.0	9.8	1.6	13.3	30.2	2	3.4	1.5
		Average	294	221	101	95	99	7.1	10.0	1.3	8.1	21.9	4	4.4	1.6
1200 rpm	2X	4/12/74	280	129	890	875	883	5.6	11.2	0.7	8.3	19.8	6	6.0	1.8
		4/30/74	355	267	752	720	720	6.2	10.3	1.0	20.8	41.8	3	4.4	1.7
		Average	318	198	821	798	802	5.9	10.8	0.9	14.6	30.8	5	5.2	1.8
1200 rpm	4X	4/12/74	209	119	1401	1433	1450	5.0	11.7	0.8	7.5	14.9	6	7.6	1.9
		4/30/74	231	333	1416	1275	1275	5.8	10.8	2.8	15.2	47.7	3	5.0	1.7
		Average	220	226	1409	1354	1363	5.4	11.3	1.8	11.4	31.3	5	6.3	1.8
2000 rpm	0	4/12/74	427	173	333	313	313	7.0	10.1	0.9	3.2	14.6	7	7.2	1.9
		4/30/74	619	400	316	297	297	7.3	9.4	1.2	9.8	39.3	4	6.0	1.8
		Average	523	287	325	305	305	7.2	9.8	1.1	6.5	27.0	6	6.6	1.9
2000 rpm	2X	4/12/74	92	282	586	566	566	2.9	14.1	0.8	2.9	14.1	6	6.5	1.8
		4/30/74	111	400	725	717	717	2.9	12.9	0.8	8.5	28.0	0	3.2	1.0
		Average	102	341	656	642	642	2.9	13.5	0.8	5.7	21.1	3	4.9	1.4
2000 rpm	4X	4/12/74	44	658	649	625	625	1.6	14.5	0.9	2.7	12.4	5	5.1	1.7
		4/30/74	81	533	743	733	733	1.9	13.7	0.9	9.1	25.0	2	2.9	1.5
		Average	63	596	696	679	679	1.8	14.1	0.9	5.9	18.7	4	4.0	1.6
Idle		4/12/74	131	82	57	66	67	6.2	10.9	0.6	6.4	22.0	5	5.7	1.7
		4/30/74	100	183	76	73	73	6.0	10.5	0.7	10.4	26.4	0	2.0	1.3
		Average	116	133	67	70	70	6.1	10.7	0.7	8.4	24.2	3	3.9	1.5

TABLE D-14. GASEOUS EMISSIONS SUMMARY

Vehicle: Ford LTD

Date: April 12, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
2.	Inter - 0	320	122	100	95	95	6.8	10.3	1.0	0.6	10.7	2	2.9	1.5
6.		304	105	129	95	105	7.0	10.3	0.8	5.0	14.9	5	4.5	1.7
12.		320	97	114	95	105	7.5	10.1	0.9	3.1	14.9	9	8.5	1.9
		315	108	114	95	102	7.1	10.2	0.9	2.9	13.5	5	5.3	1.7
1.	Inter - 2X	264	139	1000	950	950	5.5	11.1	0.7	14.3	15.7	6	6.6	1.8
9.		256	135	868	925	950	5.3	11.3	0.6	4.4	20.6	6	5.4	1.7
17.		320	114	802	750	750	6.0	11.1	0.8	6.2	23.1	5	5.9	1.8
		280	129	890	875	883	5.6	11.2	0.7	8.3	19.8	6	6.0	1.8
5.	Inter - 4X	224	122	1470	1475	1475	5.3	11.6	1.0	2.5	9.1	6	7.5	1.9
10.		212	131	1269	1375	1375	4.8	11.7	0.9	1.3	15.7	7	8.9	2.0
16.		192	105	1463	1450	1500	5.0	11.7	0.5	18.7	19.8	5	6.4	1.8
		209	119	1401	1433	1450	5.0	11.7	0.8	7.5	14.9	6	7.6	1.9
4.	High - 0	480	173	359	340	340	6.8	10.1	0.8	1.3	10.7	7	7.8	1.9
7.		480	208	351	300	300	7.0	10.0	1.1	1.3	16.5	5	4.6	1.7
20.		320	139	288	300	300	7.3	10.3	0.8	6.9	16.5	8	9.2	2.0
		427	173	333	313	313	7.0	10.1	0.9	3.2	14.6	7	7.2	1.9
11.	High - 2X	96	280	506	500	500	3.5	14.2	1.0	2.5	8.3	9	8.5	1.9
15.		104	327	686	637	637	2.5	13.9	0.5	5.0	19.0	6	5.7	1.8
21.		76	239	566	560	560	2.8	14.2	0.9	1.3	14.9	4	5.2	1.7
		92	282	586	566	566	2.9	14.1	0.8	2.9	14.1	6	6.5	1.8
3.	High - 4X	40	493	653	650	650	1.8	14.5	1.0	2.5	9.1	6	4.4	1.6
13.		40	884	644	600	600	1.5	14.2	0.9	4.4	13.2	4	4.9	1.7
19.		52	597	649	625	625	1.5	14.8	0.9	1.3	14.9	5	6.0	1.8
		44	658	649	625	625	1.6	14.5	0.9	2.7	12.4	5	5.1	1.7
8.	Idle	160	105	78	65	67	6.0	10.8	0.8	2.5	17.3	6	7.0	1.8
14.		120	40	21	66	66	6.7	10.8	0.6	11.8	28.9	3	3.5	1.6
18.		112	101	71	67	67	6.0	11.2	0.5	5.0	19.8	6	6.5	1.8
		131	82	57	66	67	6.2	10.9	0.6	6.4	22.0	5	5.7	1.7

TABLE D-15. GASEOUS EMISSIONS SUMMARY

Vehicle: Ford LTD

Date: April 30, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL		O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results		
					NO, ppm	NO_x, ppm						LCA, µg/l	LCO, µg/l	TIA
1.	Inter - 0	216	400	78	100	100	7.0	10.0	1.6	14.3	28.9	3	3.0	1.5
7.		280	400	78	88	88	6.5	10.0	1.6	14.3	31.3	3	3.3	1.5
16.		320	200	107	98	98	7.5	9.5	1.7	11.2	30.5	1	3.9	1.6
		272	333	88	95	95	7.0	9.8	1.6	13.3	30.2	2	3.4	1.5
6.	Inter - 2X	344	400	826	700	700	6.0	10.4	1.1	31.8	58.6	3	4.1	1.6
11.		304	200	698	690	690	6.5	10.2	0.9	16.2	33.8	3	4.4	1.6
19.		416	200	734	770	770	6.0	10.4	1.0	14.3	33.0	2	4.9	1.7
		355	267	752	720	720	6.2	10.3	1.0	20.8	41.8	3	4.4	1.7
5.	Inter - 4X	232	400	1659	1375	1375	5.6	11.0	3.2	13.1	35.5	3	4.1	1.6
10.		212	400	1448	1200	1200	6.5	10.8	2.5	21.2	77.5	4	4.3	1.6
20.		298	200	1142	1250	1250	5.5	10.7	2.8	11.2	29.7	3	6.5	1.8
		231	333	1416	1275	1275	5.8	10.8	2.8	15.2	47.7	3	5.0	1.7
9.	High - 0	600	600	327	300	300	7.0	9.6	1.3	10.0	38.8	5	6.2	1.8
14.		600	200	311	300	300	7.5	9.4	0.8	8.7	25.6	3	4.9	1.7
17.		640	400	311	290	290	7.5	9.3	1.6	10.6	53.6	3	6.7	1.8
		619	400	316	297	297	7.3	9.4	1.2	9.8	39.3	4	6.0	1.8
4.	High - 2X	110	600	700	675	675	3.0	13.0	0.9	6.9	23.9	0	0.7	0.9
15.		112	200	725	700	700	3.0	12.9	0.6	11.2	39.6	0	3.0	0.5
21.		112	400	750	775	775	2.8	12.9	1.0	7.5	20.6	2	6.0	1.8
		111	400	725	717	717	2.9	12.9	0.8	8.5	28.0	0	3.2	1.0
2.	High - 4X	87	600	725	700	700	2.0	13.7	0.9	12.5	29.7	3	3.0	1.5
8.		82	600	775	725	725	1.8	13.9	0.8	8.7	25.6	3	3.1	1.5
13.		75	400	775	775	775	2.0	13.6	1.1	6.2	19.8	1	2.5	1.4
		81	533	742	733	733	1.9	13.7	0.9	9.1	25.0	2	2.9	1.5
3.	Idle	100	400	71	75	75	6.0	10.7	1.0	10.6	29.7	1	1.8	1.3
12.		80	100	71	70	71	6.0	10.4	0.6	10.0	23.1	0	2.0	1.3
18.		120	50	85	73	73	6.0	10.4	0.6	10.6	26.4	0	2.3	1.4
		100	183	76	73	73	6.0	10.5	0.7	10.4	26.4	0	2.0	1.3

*Read in percent on high-range CO instrument and converted to ppm.

TABLE D-16. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--CAPRI STANDARD EVALUATION

Condition	Load	Date	HC, ppm	CO, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
1700 rpm	0	4/24/74	1040	1.9	66	55	57	3.1	11.7	1.5	24.9	58.0	27	9.0	1.9
		4/25/74	1064	1.8	64	63	66	3.5	12.0	1.9	16.8	62.9	25	7.6	1.9
		Average	1052	1.9	65	59	62	3.3	11.9	1.7	20.9	60.5	26	8.3	1.9
1700 rpm	2X	4/24/74	1267	0.6	592	434	452	3.6	11.9	3.2	14.3	59.6	45	14.2	2.1
		4/25/74	1355	0.4	716	648	665	3.6	12.5	4.3	29.4	55.8	37	15.0	2.2
		Average	1311	0.5	654	541	559	3.6	12.2	3.7	21.9	57.7	41	14.6	2.2
1700 rpm	4X	4/24/74	1557	0.2	1584	1312	1342	3.3	12.2	5.1	14.9	55.8	31	15.2	2.0
		4/25/74	1403	0.2	1829	1513	1592	3.7	12.3	4.9	30.9	77.0	47	20.6	2.3
		Average	1480	0.2	1707	1413	1467	3.5	12.3	5.0	22.9	66.4	39	17.9	2.2
2850 rpm	0	4/24/74	150	0.4	144	106	106	1.2	13.9	1.0	21.4	57.7	40	12.4	2.1
		4/25/74	137	0.3	156	131	132	1.3	14.5	2.1	17.9	45.4	7	6.0	1.8
		Average	144	0.4	150	119	119	1.3	14.2	1.6	19.7	51.6	24	9.2	2.0
2850 rpm	2X	4/24/74	1173	0.4	2654	1650	1587	1.0	13.7	5.1	22.6	61.3	37	12.8	2.2
		4/25/74	976	0.4	2293	2083	2179	1.4	14.3	3.7	27.4	63.8	34	16.2	2.2
		Average	1075	0.4	2473	1867	1883	1.2	14.0	4.4	25.0	62.6	36	14.5	2.2
2850 rpm	4X	4/24/74	1952	3.0	1877	1558	1500	0.2	13.5	2.3	18.3	48.9	49	15.7	2.1
		4/25/74	1813	3.1	2011	1821	1925	0.5	13.8	2.5	32.0	67.6	57	13.8	2.1
		Average	1883	3.1	1944	1690	1713	0.4	13.7	2.4	25.2	58.3	53	14.8	2.1
Idle		4/24/74	2219	4.3	23	21	23	7.8	7.1	3.0	10.4	42.0	21	9.1	1.9
		4/25/74	1995	4.5	31	23	26	8.7	7.3	2.7	26.4	67.4	47	8.8	1.9
		Average	2107	4.4	27	22	25	8.3	7.2	2.9	18.4	54.7	34	9.0	1.9

TABLE D-17. GASEOUS EMISSIONS SUMMARY

Vehicle: Capri Standard

Date: April 24, 1974

				NDIR	CL							DOAS Results		
Run No.	Operating Condition	HC, ppm	CO, %	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, μg/l	LCO, μg/l	TIA
8.	Inter - 0	1120	2.0	64	49	50	2.6	12.1	1.7	18.7	50.3	39	6.3	1.8
14.		1104	2.0	71	59	59	3.4	11.6	0.9	6.9	38.8	4	4.6	1.7
21.		896	1.7	64	58	61	3.3	11.6	1.8	49.2	85.0	38	16.0	2.2
		1040	1.9	66	55	57	3.1	11.8	1.5	24.9	58.0	27	9.0	1.9
1.	Inter - 2X	1264	0.7	515	370	380	3.5	11.8	3.8	8.7	31.3	51	24.2	2.4
7.		1304	0.6	601	413	425	3.5	12.1	2.9	24.9	61.0	55	13.0	2.1
17.		1232	0.5	662	520	550	3.7	11.8	3.0	9.4	86.6	28	5.4	1.7
		1267	0.6	592	434	452	3.6	11.9	3.2	14.3	59.6	45	14.2	2.1
9.	Inter - 4X	1536	0.2	1493	1050	1050	3.3	12.3	5.2	10.0	35.5	5	3.0	1.5
11.		1664	0.3	1599	1500	1450	3.3	12.3	5.7	17.4	50.3	36	17.6	2.2
18.		1472	0.2	1659	1387	1525	3.4	12.1	4.4	17.4	81.7	52	25.0	2.4
		1557	0.2	1584	1312	1342	3.3	12.2	5.1	14.9	55.8	31	15.2	2.0
5.	High - 0	104	0.3	144	96	93	1.2	13.9	1.1	38.0	59.4	31	14.9	2.2
10.		280	0.7	144	100	100	1.0	14.2	1.2	15.6	70.1	37	8.1	1.9
16.		64	0.2	144	123	125	1.5	13.7	0.8	10.6	43.7	52	14.2	2.2
		150	0.4	144	106	106	1.2	13.9	1.0	21.4	57.7	40	12.4	2.1
2.	High - 2X	1264	0.4	3159	1575	1600	0.9	14.0	5.0	4.4	29.7	33	18.0	2.3
6.		1136	0.4	2149	1500	1575	1.0	14.0	5.2	25.5	66.0	35	16.1	2.2
15.		1120	0.3	-	1875	1900	1.2	13.2	5.0	38.0	88.3	44	11.2	2.0
		1173	0.4	2654	1650	1587	1.0	13.7	5.1	22.6	61.3	37	12.8	2.2
4.	High - 4X	2048	3.7	1587	1075	1125	0.1	13.2	2.5	20.6	50.3	39	8.4	1.9
13.		2016	3.0	1851	1725	1650	0.4	13.5	1.7	10.0	47.8	56	25.6	2.4
20.		1792	2.4	2194	1875	1725	0.2	13.7	2.6	24.3	48.7	51	13.1	2.1
		1952	2.0	1877	1558	1500	0.2	13.5	2.3	18.3	48.9	49	15.7	2.1
3.	Idle	2272	4.4	28	16	18	7.5	7.0	2.6	6.2	38.6	39	17.9	2.2
12.		2464	4.7	21	25	25	8.2	6.9	2.3	11.2	46.2	6	4.7	1.7
19.		1920	3.8	21	23	25	7.7	7.4	4.1	13.7	41.2	19	4.7	1.7
		2219	4.3	23	21	23	7.8	7.1	3.0	10.4	42.0	21	9.1	1.9

TABLE D-18. GASEOUS EMISSIONS SUMMARY

Vehicle: Capri Standard

Date: April 25, 1974

Run No.	Operating Condition	HC, ppm	CO, %	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
3.	Inter - 0	920	1.8	64	63	65	4.2	11.6	1.5	13.1	41.2	22	7.0	1.8
10.		1184	1.9	64	66	69	3.2	12.2	2.0	21.2	53.6	28	7.8	1.9
17.		1088	1.8	64	61	64	3.1	12.1	2.1	16.2	94.0	38	8.0	1.9
		1064	1.8	64	63	66	3.5	12.0	1.9	16.8	62.9	25	7.6	1.9
9.	Inter - 2X	1248	0.3	716	675	640	3.8	12.3	4.1	16.8	53.6	33	16.3	2.2
12.		1248	0.5	662	600	625	4.1	12.2	5.1	23.1	64.3	35	12.3	2.1
14.		1568	0.4	770	670	730	3.0	13.0	3.8	48.2	49.5	43	16.3	2.2
		1355	0.4	716	648	665	3.6	12.5	4.3	29.4	55.8	37	15.0	2.2
5.	Inter - 4X	1328	0.2	1810	1388	1525	3.7	12.3	6.3	28.4	70.9	38	19.2	2.3
15.		1408	0.2	1846	1600	1675	3.7	12.6	4.3	46.1	100.6	51	22.5	2.4
18.		1472	0.2	1830	1550	1575	3.7	12.1	4.1	18.1	59.4	53	20.0	2.3
		1403	0.2	1829	1513	1592	3.7	12.3	4.9	30.9	77.0	47	20.6	2.3
1.	High - 0	100	0.2	144	130	130	1.5	14.4	1.1	15.0	37.1	6	6.0	1.8
8.		120	0.3	188	133	134	1.5	14.5	1.7	17.4	42.9	6	6.6	1.8
13.		192	0.6	136	130	133	1.2	14.7	3.6	21.2	56.1	8	5.5	1.7
		137	0.3	156	131	132	1.4	14.5	2.1	17.9	45.4	7	6.0	1.8
2.	High - 2X	800	0.2	2239	2088	2225	1.5	14.2	2.9	16.2	47.0	32	17.4	2.2
7.		1088	0.3	2262	2063	2187	1.5	14.4	4.7	44.9	88.3	36	16.5	2.2
19.		1040	0.3	2378	2100	2125	1.2	14.4	3.6	21.2	56.1	33	14.6	2.2
		976	0.3	2293	2083	2179	1.4	14.3	3.7	27.4	63.8	34	16.2	2.2
4.	High - 4X	1776	2.9	1976	1863	2000	0.4	13.7	1.9	30.5	63.5	68	18.0	2.3
11.		1872	3.5	2018	1888	1850	0.6	13.9	2.8	37.4	76.7	51	11.1	2.0
20.		1792	2.8	2039	1713	1925	0.5	13.9	2.8	28.0	62.7	51	12.3	2.1
		1813	3.1	2011	1821	1925	0.5	13.8	2.5	32.0	67.6	57	13.8	2.1
6.	Idle	2080	4.9	49	24	28	8.5	7.4	2.6	17.4	42.9	56	11.5	2.1
16.		1856	4.2	14	22	28	9.0	7.2	2.9	44.9	101.5	49	9.6	2.0
21.	2	2048	4.5	28	24	23	8.5	7.4	2.6	16.8	57.7	37	5.3	1.7
		1995	4.5	31	23	26	8.7	7.3	2.7	26.4	67.4	47	8.8	1.9

TABLE D-19. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--CAPRI PROCO EVALUATION

					NDIR	CL							DOAS Results		
Condition	Load	Date	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, µg/l	LCO, µg/l	TIA
1700 rpm	0	5/7/74	21	5	131	119	119	5.5	10.9	0	1.6	6.9	0	0.7	0.7
		5/9/74	21	0	105	99	100	5.2	11.4	0	0	12.0	0	0.5	0.6
		Average	21	3	118	109	110	5.4	11.2	0	0.8	9.5	0	0.6	0.7
1700 rpm	2X	5/7/74	6	8	321	320	308	2.5	13.8	0	1.9	7.1	0	0.7	0.8
		5/9/74	8	0	254	237	237	1.8	14.7	0	0	8.1	0	0.4	0.6
		Average	7	4	288	279	273	2.2	14.3	0	1.0	7.6	0	0.6	0.7
1700 rpm	4X	5/7/74	8	0	692	675	678	2.8	13.3	0	3.5	8.5	0	0.5	0.6
		5/9/74	8	0	644	610	610	3.0	13.5	0	0	9.5	0	0.3	0.4
		Average	8	0	668	643	644	2.9	13.4	0	1.8	9.0	0	0.4	0.5
2850 rpm	0	5/7/74	7	8	216	212	214	5.2	11.5	0.1	4.4	9.5	0	0.7	0.6
		5/9/74	10	0	208	194	194	4.3	12.1	0	0	6.6	0	0.4	0.5
		Average	9	4	212	203	204	4.8	11.8	0.1	2.2	8.1	0	0.6	0.6
2850 rpm	2X	5/7/74	1	11	908	868	856	1.7	14.3	0	3.4	8.0	0	0.4	0.5
		5/9/74	8	0	833	793	806	2.0	14.4	0	0	6.6	0	0.4	0.5
		Average	5	6	871	831	831	1.9	14.4	0	1.7	7.3	0	0.4	0.5
2850 rpm	4X	5/7/74	16	16	1464	1350	1354	4.5	11.7	0	2.0	6.0	1	1.4	1.1
		5/9/74	24	0	1328	1283	1291	4.8	11.7	0	0	12.9	6	1.1	1.0
		Average	20	8	1396	1317	1323	4.7	11.7	0	1.0	9.5	4	1.3	1.1
Idle		5/7/74	53	9	47	68	68	9.3	8.0	0	3.3	9.1	0	0.6	0.8
		5/9/74	49	0	45	54	54	9.0	8.2	0	0	7.4	0	0.3	0.4
		Average	51	5	46	61	61	9.2	8.1	0	1.7	8.3	0	0.5	0.6

TABLE D-20. GASEOUS EMISSIONS SUMMARY

Vehicle: Capri PROCO

Date: May 7, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
8.	Inter - 0	25	8	210	120	120	5.0	11.1	0	1.9	8.2	0	0.5	0.7
12.		18	8	100	125	125	5.5	10.8	0	1.2	4.9	0	1.3	1.1
19.		17	0	85	112	112	6.0	10.8	0	1.6	7.7	0	0.2	0.4
		21	5	131	119	119	5.5	10.9	0	1.6	6.9	0	0.7	0.7
5.	Inter - 2X	6	24	311	300	290	2.5	14.0	0	1.9	7.4	0	0.6	0.8
14.		7	0	343	350	330	2.5	13.7	0	1.2	6.6	0	1.3	1.1
16.		6	0	311	310	305	2.5	13.7	0	2.5	7.4	0	0.2	0.4
		6	8	321	320	308	2.5	13.8	0	1.9	7.1	0	0.7	0.8
4.	Inter - 4X	5	0	716	640	650	3.0	13.5	0	4.4	9.9	0	0.8	0.9
7.		10	0	698	725	725	2.5	13.5	0	3.1	9.9	0	0.3	0.5
15.		9	0	662	660	660	3.0	12.9	0	3.1	5.8	0	0.3	0.5
		8	0	692	675	678	2.8	13.3	0	3.5	8.5	0	0.5	0.6
1.	High - 0	1	20	226	215	218	5.0	12.3	0.2	3.3	7.8	0	0.1	0.0
13.		13	4	219	220	220	5.5	11.1	0	4.2	9.0	0	1.8	1.3
20.		7	0	204	200	205	5.0	11.1	0	5.6	11.7	0	0.4	0.6
		7	8	216	212	214	5.2	11.5	0.1	4.4	9.5	0	0.7	0.6
2.	High - 2X	1	24	902	830	820	1.5	14.7	0	5.3	14.8	0	0.3	0.5
11.		1	8	921	900	875	2.0	14.4	0	1.2	5.8	0	0.9	1.0
18.		1	0	902	875	875	2.0	13.7	0	0.6	3.3	0	0.1	0.0
		1	11	908	868	856	1.7	14.3	0	3.4	8.0	0	0.4	0.5
6.	High - 4X	22	20	1610	1400	1413	4.5	11.8	0	3.6	7.2	3.8	1.9	1.3
9.		18	24	1493	1425	1425	4.0	11.8	0.1	1.2	5.8	0	1.0	1.0
21.		9	4	1291	1225	1225	5.0	11.6	0	1.2	4.9	0	1.2	1.1
		16	16	1464	1350	1354	4.5	11.7	0	2.0	6.0	1.3	1.4	1.1
3.	Idle	55	20	57	70	75	9.5	8.1	0	7.5	16.5	0	0.7	0.8
10.		51	8	42	65	65	8.5	8.1	0	1.2	6.6	0	0.7	0.8
17.		50	0	42	68	68	10.0	7.8	0	1.2	4.1	0	0.5	0.7
		52	9	47	68	68	9.3	8.0	0	3.3	9.1	0	0.6	0.8

TABLE D-21. GASEOUS EMISSIONS SUMMARY

Vehicle: Capri PROCO

Date: May 9, 1974

				NDIR	CL								DOAS Results		
Run No.	Operating Condition	HC, ppm	CO, ppm	NO, ppm	NO, ppm	NO_x ppm	O_2 %	CO_2 %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, μg/l	LCO, μg/l	TIA
3.	Inter - 0	21	0	85	95	98	5.5	11.6	0	0	11.7	0	1.0	1.0
10.		21	0	144	103	103	5.0	11.6	0	0	11.2	0	0.2	0.3
14.		20	0	85	100	100	5.0	11.1	0	0	13.2	0	0.3	0.5
		21	0	105	99	100	5.2	11.4	0	0	12.0	0	0.5	0.6
6.	Inter - 2X	7	0	280	260	260	1.5	15.0	0	0	7.7	0	0.4	0.6
8.		7	0	264	240	240	1.5	15.0	0	0	6.6	0	0.4	0.6
17.		9	0	219	213	213	2.5	14.0	0	0	9.9	0	0.5	0.7
		8	0	254	237	237	1.8	14.7	0	0	8.1	0	0.4	0.6
7.	Inter - 4X	6	0	662	620	620	2.5	14.4	0	0	9.7	0	0.4	0.6
15.		9	0	627	610	610	3.0	13.2	0	0	8.2	0	0.4	0.6
18.		10	0	644	600	600	3.5	12.9	0	0	10.7	0	0.0	0
		8	0	644	610	610	3.0	13.5	0	0	9.5	0	0.3	0.4
2.	High - 0	14	0	188	188	188	4.0	12.3	0	0	7.4	0	0.7	0.8
9.		7	0	249	193	193	4.0	12.3	0	0	7.4	0	0.5	0.7
21.		8	0	188	200	200	5.0	11.6	0	0	4.9	0	0.0	0
		10	0	208	194	194	4.3	12.1	0	0	6.6	0	0.4	0.5
4.	High - 2X	12	0	864	800	840	1.5	14.4	0	0	4.9	0	0.8	0.9
11.		4	0	883	830	830	2.0	15.0	0	0	9.9	0	0.4	0.6
20.		7	0	752	750	750	2.5	13.7	0	0	4.9	0	0.0	0
		8	0	833	793	806	2.0	14.4	0	0	6.6	0	0.4	0.5
1.	High - 4X	28	0	1379	1325	1325	4.5	11.8	0	0	10.7	0	1.5	1.2
13.		24	0	1357	1300	1300	5.0	11.6	0	0	16.5	0	1.3	1.1
16.		20	0	1248	1225	1250	5.0	11.6	0	0	11.5	0	0.5	0.7
		24	0	1328	1283	1291	4.8	11.7	0	0	12.9	0	1.1	1.0
5.	Idle	50	0	49	52	53	8.5	8.3	0	0	4.9	0	0.5	0.7
12.		48	0	42	60	60	8.5	8.5	0	0	10.6	0	0.3	0.5
19.		50	0	42	50	50	10.0	7.9	0	0	6.6	0	0.1	0.0
		49	0	45	54	54	9.0	8.2	0	0	7.4	0	0.3	0.4

TABLE D-22. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--TEXACO TCCS CRICKET EVALUATION, DIESEL

Condition	Load	Date	HC, ppm	CO, ppm	CL		O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results		
					NO, ppm	NO$_x$, ppm						LCA, g/l	LCO, μg/l	TIA
1800 rpm	0	10/15/74	2824	955	45	50	14.1	2.06	10.6	64.6	137.5	230.7	34.2	2.5
		10/17/74	1797	919	45	50	17.3	1.96	8.4	45.7	104.6	177.6	25.6	2.4
		Average	2311	937	45	50	15.7	2.01	9.5	55.2	121.1	204.2	29.9	2.5
1800 rpm	1.5X	10/15/74	592	121	117	123	12.5	4.85	3.5	24.1	49.2	158.6	30.8	2.5
53.1 km/hr		10/17/74	892	150	128	131	14.7	4.08	8.6	38.8	66.0	201.3	36.1	2.5
		Average	742	136	123	127	13.6	4.47	6.1	31.5	57.6	180.0	33.5	2.5
1800 rpm	3X	10/15/74	1835	105	252	262	11.2	6.10	3.1	33.0	64.6	188.4	30.2	2.4
53.1 km/hr		10/17/74	529	78	228	232	12.9	5.45	3.8	46.1	65.2	130.9	22.4	2.4
		Average	1182	92	240	247	12.0	5.77	3.5	39.6	64.9	159.7	26.3	2.4
3000 rpm	0	10/15/74	2043	770	63	68	15.2	2.52	8.7	39.5	105.6	180.3	33.2	2.5
		10/17/74	1925	898	57	63	16.8	2.51	10.7	48.8	95.7	209.3	35.7	2.6
		Average	1984	834	60	66	16.0	2.52	9.7	44.2	100.7	194.8	34.5	2.6
3000 rpm	1/5X	10/15/74	342	98	327	338	12.2	5.40	3.6	60.2	81.1	139.9	19.5	2.2
90.1 km/hr		10/17/74	320	142	290	295	13.0	5.29	5.0	39.8	61.2	138.9	22.5	2.4
		Average	331	120	309	317	12.6	5.35	4.3	50.0	71.1	139.4	21.0	2.3
3000 rpm	3X	10/15/74	181	67	727	747	8.2	8.31	4.3	36.8	50.0	133.8	20.8	2.2
90.1 km/hr		10/17/74	1117	82	765	782	10.0	7.89	6.6	88.5	91.8	127.9	17.0	2.2
		Average	649	75	746	765	9.1	8.10	5.5	62.7	70.9	130.9	18.9	2.2
Idle		10/15/74	266	15	91	95	12.8	3.90	6.6	34.7	62.7	132.8	14.9	2.1
		10/17/74	1808	1518	76	78	17.0	2.54	10.4	57.9	137.7	159.3	17.3	2.2
		Average	1037	767	84	87	14.9	3.22	8.5	46.3	100.2	146.1	16.1	2.2
Cold Start		10/15/74	3552	1874	35	45	16.3	3.31						
		10/17/74	3968	3212	30	45	16.5	3.43						
		Average	3760	2543	33	45	16.4	3.37						

TABLE D-23. GASEOUS EMISSIONS SUMMARY

Vehicle: Texaco TCCS Cricket - Diesel

Date: October 15, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	CL		O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results		
				NO, ppm	NO$_x$, ppm						LCA, μg/l	LCO, μg/l	TIA
7.	Inter - 0	4096	1068	30	40	14.4	2.06	17.5	77.9	185.6	236.2	38.6	2.6
12.		2720	973	45	50	14.0	1.96	9.9	64.8	142.7	222.8	35.2	2.5
14.		1648	823	60	60	13.8	2.16	4.5	51.1	84.1	233.0	28.7	2.5
		2824	955	45	50	14.1	2.06	10.6	64.6	137.5	230.7	34.2	2.5
6.	Inter - 1.5X	400	56	67	69	9.9	6.23	3.1	21.2	36.3	160.8	33.8	2.5
17.		528	85	150	160	14.4	4.26	2.6	24.9	50.3	175.5	30.0	2.5
21.		848	222	135	140	13.3	4.06	4.7	26.2	61.0	139.5	28.7	2.5
		592	121	117	123	12.5	4.85	3.5	24.1	49.2	158.6	30.8	2.5
3.	Inter - 3X	2080	89	240	245	11.3	5.90	1.6	17.4	37.9	106.1	13.4	2.1
8.		2320	123	270	290	9.6	6.41	5.6	54.2	93.2	260.6	40.3	2.6
15.		1104	104	245	250	12.8	5.98	2.0	27.4	62.7	198.6	36.9	2.6
		1835	105	252	262	11.2	6.10	3.1	33.0	64.6	188.4	30.2	2.4
2.	High - 0	1824	846	63	68	15.6	2.47	8.5	32.4	94.9	128.5	27.1	2.4
9.		2352	565	60	65	13.8	2.52	10.6	49.2	121.2	220.1	37.4	2.6
18.		1952	900	65	70	16.1	2.57	6.9	36.8	100.6	192.2	35.2	2.5
		2043	770	63	68	15.2	2.52	8.7	39.5	105.6	180.3	33.2	2.5
1.	High - 1.5X	105	75	300	320	12.9	5.19	2.0	13.1	23.1	6.8	3.6	1.6
10.		672	116	345	350	10.6	5.42	6.5	136.4	168.3	242.0	31.2	2.5
16.		248	102	335	345	13.1	5.58	2.3	31.2	52.0	160.6	23.6	2.4
		342	98	327	338	12.2	5.40	3.6	60.2	81.1	139.9	19.5	2.2
4.	High - 3X	44	56	700	720	8.3	8.24	3.4	21.8	34.6	26.6	7.8	1.9
13.		384	73	730	750	7.4	8.35	4.6	53.6	65.2	203.9	27.0	2.4
19.		114	73	750	770	8.8	8.35	4.8	34.9	50.3	170.8	27.6	2.4
		181	67	727	747	8.2	8.31	4.3	36.8	50.0	133.8	20.8	2.2
5.	Idle	108	11	63	65	10.6	5.82	4.9	15.6	25.6	15.0	4.3	1.6
11.		444	20	80	85	13.3	2.79	8.6	55.4	105.6	234.8	24.2	2.4
20.		247	13	130	135	14.6	3.10	6.2	33.0	56.7	148.6	16.1	2.2
		266	15	91	95	12.8	3.90	6.6	34.7	62.7	132.8	14.9	2.1
A.	Cold Start	3552	1874	35	45	16.3	3.31						

TABLE D-24. GASEOUS EMISSIONS SUMMARY

Vehicle: Texaco TCCS Cricket - Diesel

Date: October 17, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	CL		O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results		
				NO, ppm	NO$_x$, ppm						LCA, µg/l	LCO, µg/l	TIA
8.	Inter - 0	2016	992	45	50	16.1	1.96	11.6	46.7	100.6	190.4	23.0	2.4
10.		1600	882	45	50	18.0	2.11	7.8	34.9	92.7	167.8	22.4	2.4
15.		1776	882	45	50	17.9	1.81	5.8	55.4	120.4	174.7	31.5	2.5
		1797	919	45	50	17.3	1.96	8.4	45.7	104.6	177.6	25.6	2.4
1.	Inter - 1.5X	588	71	130	133	15.8	3.80	8.6	24.9	46.2	164.3	24.6	2.4
5.		1032	195	125	125	13.9	4.19	11.6	31.2	66.0	209.2	30.2	2.5
16.		1056	184	130	135	14.5	4.26	5.6	60.4	85.8	230.5	53.4	2.7
		892	150	128	131	14.7	4.08	8.6	38.8	66.0	201.3	36.1	2.5
7.	Inter - 3X	420	95	230	230	12.0	5.34	4.3	39.8	56.1	118.3	17.8	2.3
14.		448	83	245	250	12.8	5.65	5.6	57.9	85.0	174.7	31.5	2.5
19.		720	56	210	215	13.9	5.26	1.6	40.5	54.4	99.6	18.0	2.3
		529	78	228	232	12.9	5.45	3.8	46.1	65.2	130.9	22.4	2.4
4.	High - 0	1840	743	60	70	16.0	2.68	11.6	44.9	84.1	255.1	39.8	2.6
13.		1696	882	60	65	17.4	2.42	11.3	49.8	101.5	181.2	32.4	2.5
20.		2240	1068	50	55	17.1	2.42	9.1	51.7	101.5	191.7	35.8	2.6
		1925	898	57	63	16.8	2.51	10.7	48.8	95.7	209.3	35.7	2.6
6.	High - 1.5X	284	187	270	275	12.3	5.34	4.8	33.6	53.6	147.0	23.3	2.4
12.		292	106	310	320	13.3	5.34	7.2	47.3	67.6	158.6	21.4	2.3
21.		384	132	290	290	13.3	5.19	3.0	38.6	62.3	111.1	22.7	2.4
		320	142	290	295	13.0	5.29	5.0	39.8	61.2	138.9	22.5	2.4
3.	High - 3X	480	73	685	695	9.9	7.82	8.3	117.7	124.5	100.4	10.5	2.0
9.		440	66	810	835	10.3	7.72	5.6	58.6	70.9	163.7	18.8	2.3
18.		2432	106	800	815	9.9	8.13	6.0	89.1	80.0	119.6	21.7	2.3
		1117	82	765	782	10.0	7.89	6.6	88.5	91.8	127.9	17.0	2.2
2.	Idle	1600	1579	89	90	16.8	2.63	8.5	62.9	173.2	157.9	16.9	2.2
11.		2208	1487	55	60	17.6	2.26	11.9	62.9	129.4	161.5	23.6	2.4
17.		1616	1487	85	85	16.6	2.74	10.8	48.0	110.5	158.6	11.4	2.1
		1808	1518	76	78	17.0	2.54	10.4	57.9	137.7	159.3	17.3	2.2
A.	Cold Start	3968	3212	30	45	16.5	3.43						

TABLE D-25. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--TEXACO TCCS CRICKET EVALUATION, GASOLINE

					CL							DOAS Results		
Condition	Load	Date	HC, ppm	CO, ppm	NO, ppm	NO_x, ppm	O_2, %	CO_2, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, $\mu g/l$	LCO, $\mu g/l$	TIA
1800 rpm	0	10/8/74	2037	461	51	57	15.7	2.06	5.9	27.6	49.5	20.1	8.4	1.9
		10/11/74	2603	534	43	48	15.1	1.99	4.9	16.4	34.6	18.6	5.3	1.7
		Average*	2320	498	47	53	15.4	2.03	5.4	22.0	42.1	19.4	6.9	1.8
1800 rpm 53.1 km/hr	1.5X	10/8/74	404	29	133	140	13.8	3.84	1.3	14.5	20.4	5.6	3.2	1.5
		10/11/74	576	35	115	122	14.1	3.97	1.4	12.2	21.3	6.0	4.8	1.6
		Average	490	32	124	131	14.0	3.91	1.4	13.4	20.9	5.8	4.0	1.6
1800 rpm 53.1 km/hr	3X	10/8/74	181	26	255	275	11.2	5.61	2.0	14.3	28.1	4.2	2.9	1.5
		10/11/74	244	25	227	238	11.2	5.76	1.0	13.3	22.3	1.6	2.5	1.4
		Average	213	26	241	257	11.2	5.69	1.5	13.8	25.2	2.9	2.7	1.5
3000 rpm	0	10/8/74	2389	212	52	57	15.0	2.70	5.6	15.0	29.4	20.1	8.0	1.9
		10/11/74	2400	165	48	53	15.3	2.79	3.6	14.8	31.1	23.4	9.5	2.0
		Average	2395	189	50	55	15.2	2.75	4.6	14.9	30.3	21.8	8.8	2.0
3000 rpm 90.1 km/hr	1.5X	10/8/74	176	47	317	333	11.5	5.42	3.3	13.9	21.4	4.8	3.4	1.5
		10/11/74	163	31	258	272	12.3	5.34	1.0	13.5	24.5	2.5	2.6	1.4
		Average	170	39	288	303	11.9	5.38	2.2	13.7	23.0	3.7	3.0	1.5
3000 rpm 90.1 km/hr	3X	10/8/74	36	42	697	743	8.3	8.10	2.4	14.5	23.1	2.6	2.2	1.3
		10/11/74	43	40	618	705	8.3	8.10	1.8	14.9	23.6	2.6	1.8	1.2
		Average	40	41	658	724	8.3	8.10	2.1	14.7	23.4	2.6	2.0	1.3
Idle		10/8/74	845	17	92	96	13.3	4.08	1.6	17.9	30.8	13.5	2.6	1.4
		10/11/74	1781	176	85	87	14.7	2.94	1.5	13.5	32.2	13.4	2.7	1.4
		Average	1313	97	89	92	14.0	3.51	1.6	15.7	31.5	13.5	2.7	1.4
Cold Start		10/8/74	-	-	80	80	14.4	4.12						
		10/11/74	5056	1147	75	80	15.5	3.37						
		Average	5056	1147	78	80	15.0	3.75						

*Average based on before (10/8/74) and after (10/11/74) timing adjustment.

TABLE D-26. GASEOUS EMISSIONS SUMMARY

Vehicle: Texaco TCCS Cricket - Gasoline

Date: October 8, 1974

Run	Operating	HC,	CO,	CL		O$_2$,	CO$_2$,	Acrolein,	Formaldehyde,	Aliphatic Aldehydes,	DOAS Results		
No.	Condition	ppm	ppm	NO, ppm	NO$_x$, ppm	%	%	ppm	ppm	ppm	LCA, µg/l	LCO, µg/l	TIA
7.	Inter - 0	2272	539	50	60	16.1	2.06	12.7	39.8	50.3	32.8	14.7	2.2
13.		1824	468	55	60	15.6	2.01	0.8	21.2	48.7	15.0	6.0	1.8
15.		2016	377	47	50	15.5	2.11	4.1	21.8	49.5	12.4	4.4	1.6
		2037	461	51	57	15.7	2.06	5.9	27.6	49.5	20.1	8.4	1.9
2.	Inter - 1.5X	576	47	115	120	13.0	4.06	1.3	13.1	15.7	9.1	4.8	1.7
12.		340	21	150	155	13.6	3.80	1.3	11.2	26.4	5.0	3.0	1.5
19.		296	18	135	145	14.9	3.67	1.4	19.3	19.0	2.8	1.7	1.2
		404	29	133	140	13.8	3.84	1.3	14.5	20.4	5.6	3.2	1.5
3.	Inter - 3X	180	25	240	255	11.0	5.50	1.3	8.7	19.8	4.8	2.9	1.5
9.		244	38	240	260	11.6	5.58	2.9	18.7	32.2	5.3	4.1	1.6
16.		118	16	285	310	11.1	5.74	1.8	15.6	32.2	2.6	1.8	1.3
		181	26	255	275	11.2	5.61	2.0	14.3	28.1	4.2	2.9	1.5
4.	High - 0	2048	157	50	55	13.8	2.68	3.8	8.7	31.3	22.1	8.0	1.9
8.		2752	268	55	60	15.0	2.79	7.1	20.6	42.9	22.2	9.0	2.0
20.		2368	211	50	55	16.1	2.63	5.9	15.6	14.0	16.0	7.1	1.9
		2389	212	52	57	15.0	2.70	5.6	15.0	29.4	20.1	8.0	1.9
5.	High - 1.5X	210	62	310	320	10.5	5.50	1.7	12.5	23.9	9.4	4.9	1.7
11.		134	40	335	360	11.6	5.42	5.4	17.4	31.3	3.4	2.7	1.4
21.		184	40	305	320	12.5	5.34	2.7	11.8	9.1	1.6	2.7	1.4
		176	47	317	333	11.5	5.42	3.3	13.9	21.4	4.8	3.4	1.5
6.	High - 3X	30	47	620	660	7.9	7.82	1.6	11.2	19.0	3.1	2.0	1.3
14.		33	44	730	780	8.0	8.46	3.9	16.8	36.3	1.7	2.2	1.3
18.		46	36	740	790	9.1	8.03	1.7	15.6	14.0	3.0	2.4	1.4
		36	42	697	743	8.3	8.10	2.4	14.5	23.1	2.6	2.2	1.3
1.	Idle	1168	21	85	90	13.3	4.12	2.6	15.6	28.0	16.0	3.3	1.5
10.		864	17	90	93	13.4	4.12	1.5	21.2	33.0	14.4	2.5	1.4
		504	13	100	105	13.3	3.99	0.7	16.8	31.3	10.0	1.9	1.3
		845	17	92	96	13.3	4.08	1.6	17.9	30.8	13.5	2.6	1.4
A.	Cold Start	-	-	80	80	14.4	4.12						

TABLE D-27. GASEOUS EMISSIONS SUMMARY

Vehicle: Texaco TCCS Cricket - Gasoline

Date: October 11, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
7.	Inter - 0	2656	548	40	45	14.6	1.96	4.9	14.3	33.8	19.6	6.8	1.8
9.		2144	412	45	50	14.3	2.01	5.0	15.0	22.2	18.1	5.7	1.8
15.		3008	643	45	50	16.4	2.01	4.7	19.9	47.8	17.8	3.3	1.5
		2603	534	43	48	15.1	1.99	4.9	16.4	34.6	18.6	5.3	1.7
3.	Inter - 1.5X	584	36	115	120	13.8	3.86	1.2	8.1	17.3	5.4	4.0	1.6
10.		696	44	110	120	15.1	4.12	1.9	19.3	30.0	9.8	7.6	1.9
20.		448	24	120	125	13.5	3.93	1.2	9.3	16.5	2.9	2.8	1.4
		576	35	115	122	14.1	3.97	1.4	12.2	21.3	6.0	4.8	1.6
6.	Inter - 3X	300	24	195	205	10.6	5.65	0.9	8.7	19.0	1.5	2.6	1.4
13.		236	28	255	270	11.8	5.90	1.3	23.7	35.5	1.8	2.2	1.3
19.		196	24	230	240	11.1	5.74	0.8	7.5	12.4	1.5	2.7	1.4
		244	25	227	238	11.2	5.76	1.0	13.3	22.3	1.6	2.5	1.4
2.	High - 0	2176	156	50	55	15.5	2.79	3.7	10.0	23.9	22.9	9.7	2.0
14.		2880	191	45	50	15.5	2.79	3.9	23.7	46.3	27.6	10.8	2.0
18.		2144	148	50	53	15.0	2.79	3.1	10.6	23.1	19.6	8.1	1.9
		2400	165	48	53	15.3	2.79	3.6	14.8	31.1	23.4	9.5	2.0
1.	High - 1.5X	122	24	275	285	12.1	5.26	0.7	15.0	26.4	2.9	2.4	1.4
11.		212	40	240	260	12.8	5.42	1.5	9.3	20.6	3.8	3.6	1.6
17.		156	28	260	270	11.9	5.34	0.8	16.2	26.4	1.5	1.7	1.2
		163	31	258	272	12.3	5.34	1.0	13.5	24.5	2.5	2.6	1.4
4.	High - 3X	37	40	640	700	8.5	8.13	1.1	10.6	17.3	2.5	1.7	1.2
8.		53	36	555	605	7.9	8.03	2.0	14.3	22.2	2.4	1.7	1.2
16.		40	44	660	810	8.6	8.13	2.2	19.9	31.3	2.9	2.1	1.3
		43	40	618	705	8.3	8.10	1.8	14.9	23.6	2.6	1.8	1.2
5.	Idle	1280	12	80	80	13.9	3.13	2.2	12.5	27.2	11.5	2.5	1.4
12.		1504	89	80	85	15.6	2.90	1.7	13.1	37.1	11.0	2.2	1.3
21.		2560	427	95	95	14.6	2.79	0.6	15.0	32.2	17.8	3.3	1.5
		1781	176	85	87	14.7	2.94	1.5	13.5	32.2	13.4	2.7	1.4
A.	Cold Start	5056	1147	75	80	16.5	3.37						

TABLE D-28. EMISSIONS OBTAINED SIMULTANEOUSLY WITH ODOR RATINGS--HONDA CVCC CIVIC EVALUATION

						CL								DOAS Results		
Condition	Load	Date	HC, ppm	CO, ppm	NDIR NO, ppm	NO, ppm	NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	LCA, μg/l	LCO, μg/l	TIA
2300 rpm	0	10/31/74	201	4929		78	83	3.6	12.63	1.6	18.4	35.7	6.9	3.8	1.5
		11/5/74	114	3537	139	98	102	2.4	13.47	1.3	18.5	36.7	5.5	2.5	1.3
		Average	158	4233		88	93	3.0	13.05	1.5	18.5	36.2	6.2	3.2	1.4
2300 rpm 54.2 km/hr	1.5X	10/31/74	35	1957		360	378	2.7	13.28	0.9	11.1	20.5	5.7	2.0	1.3
		11/5/74	40	1829	602	491	503	1.9	13.75	0.9	6.0	12.9	6.0	4.0	1.3
		Average	38	1893		425	441	2.3	13.52	0.9	8.6	16.7	5.9	3.0	1.3
2300 rpm 54.2 km/hr	3X	10/31/74	126	2727		1221	1258	2.9	13.12	1.2	3.9	14.1	4.6	2.0	1.3
		11/5/74	84	2728	1284	1055	1071	2.6	13.23	1.0	3.5	13.5	1.3	1.2	1.0
		Average	105	2728		1138	1165	2.8	13.18	1.1	3.7	13.8	3.0	1.6	1.2
3800 rpm	0	10/31/74	42	405		118	125	2.8	13.40	0.8	4.4	16.5	5.1	3.5	1.5
		11/5/74	32	610	167	132	137	2.4	13.46	0.6	3.1	9.6	2.9	1.8	1.2
		Average	37	508		125	131	2.6	13.43	0.7	3.8	13.1	4.0	2.7	1.4
3800 rpm 90.1 km/hr	1.5X	10/31/74	27	442		801	827	2.6	13.45	1.7	6.7	12.0	2.8	1.7	1.2
		11/5/74	38	396	1368	1125	1146	2.7	13.62	2.3	11.8	17.0	2.1	4.3	1.5
		Average	33	419		963	987	2.7	13.54	2.0	9.3	14.5	2.5	3.0	1.4
3800 rpm 90.1 km/hr	3X	10/31/74	69	1413		1992	2043	1.9	13.74	3.0	13.4	19.9	4.5	3.3	1.4
		11/5/74	51	1801	3011	2766	2866	1.7	14.10	2.9	11.4	21.5	2.9	1.8	1.2
		Average	60	1607		2379	2455	1.8	13.92	3.0	12.4	20.7	3.7	2.6	1.3
Idle		10/31/74	704	4309		62	67	3.8	12.52	6.3	6.8	18.1	39.4	13.2	2.1
		11/5/74	559	5282	100	69	72	3.5	12.63	5.7	6.4	25.3	30.0	10.1	2.0
		Average	632	4796		66	70	3.7	12.58	6.0	6.6	21.7	34.7	11.7	2.1
Cold Start		10/29/74	10,816	5394		55	60	8.3	11.56						
		10/31/74	12,288	6765		29	34	8.8	11.46						
		11/5/74	12,800	-	36	20	20	6.5	11.46						
		Average	11,968	6080		35	38	7.9	11.49						

TABLE D-29. GASEOUS EMISSIONS SUMMARY

Vehicle: Honda CVCC Civic

Date: October 31, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	Cl NO, ppm	Cl NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, μg/l	DOAS Results LCO, μg/l	DOAS Results TIA
1.	Inter - 0	300	4840	65	70	3,4	12,52	2,0	24,2	44,1	9,1	6,7	1,8
7.		132	4612	90	95	3,6	12,68	1,5	13,7	29,0	6,3	2,6	1,4
12.		172	5336	80	85	3,8	12,68	1,4	17,4	34,1	5,3	2,1	1,3
		201	4929	78	83	3,6	12,63	1,6	18,4	35,7	6,9	3,8	1,5
5.	Inter - 1,5X	58	2571	340	360	2,5	13,17	1,0	15,1	22,1	7,6	2,0	1,3
11.		24	1626	350	365	2,8	13,34	0,9	13,1	23,3	4,7	1,8	1,3
17.		22	1674	390	410	2,9	13,34	0,8	5,0	16,0	4,9	2,1	1,3
		35	1957	360	378	2,7	13,28	0,9	11,1	20,5	5,7	2,0	1,3
6.	Inter - 3X	184	2636	1237	1262	3,0	13,17	1,5	3,7	14,1	6,7	2,4	1,4
15.	(high by 3 hp)	114	2772	1150	1187	2,8	13,17	1,0	5,0	15,0	4,6	2,2	1,3
21.		80	2772	1275	1325	3,0	13,01	1,0	3,1	13,2	2,4	1,4	1,1
		126	2727	1221	1258	2,9	13,12	1,2	3,9	14,1	4,6	2,0	1,3
2.	High - 0	50	433	110	115	2,5	13,51	0,9	4,3	19,0	7,5	4,0	1,6
14.		11	306	125	135	2,8	13,51	0,7	5,8	15,7	3,5	1,4	1,1
19.		68	477	120	125	3,0	13,17	0,7	3,0	14,8	4,3	5,0	1,7
		43	405	118	125	2,8	13,40	0,8	4,4	16,5	5,1	3,5	1,5
8.	High - 1,5X	28	450	787	812	2,6	13,51	2,2	8,0	14,0	3,2	1,7	1,2
13.	(low by 3 hp)	29	450	730	745	2,6	13,51	1,1	5,6	11,3	3,3	1,6	1,2
20.		25	425	887	925	2,6	13,34	1,8	6,2	10,8	2,0	1,9	1,2
		27	442	801	827	2,6	13,45	1,7	6,7	12,0	2,8	1,7	1,2
4.	High - 3X	80	1398	2250	2375	1,5	13,68	3,5	26,0	33,3	5,4	5,1	1,7
10.		76	1442	1835	1850	2,3	13,68	3,0	9,1	18,5	5,5	3,4	1,5
16.		50	1398	1890	1905	1,9	13,86	2,6	5,0	8,0	2,6	1,3	1,1
		69	1413	1992	2043	1,9	13,74	3,0	13,4	19,9	4,5	3,3	1,4
3.	Idle	720	2114	60	65	3,3	12,68	8,0	8,1	19,0	47,5	14,4	2,2
9.		480	5207	65	70	3,8	12,68	6,0	6,8	15,6	28,2	9,8	2,0
18.		912	5606	60	65	4,4	12,21	4,9	5,5	19,6	42,6	15,3	2,2
		704	4309	62	67	3,8	12,52	6,3	6,8	18,1	39,4	13,2	2,1
A.	Cold Start	12,288	6765	29	34	8,8	11,46						

TABLE D-30. GASEOUS EMISSIONS SUMMARY

Vehicle: Honda CVCC Civic

Date: November 5, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NDIR NO, ppm	CL NO, ppm	CL NO$_x$, ppm	O$_2$, %	CO$_2$, %	Acrolein, ppm	Formaldehyde, ppm	Aliphatic Aldehydes, ppm	DOAS Results LCA, µg/l	DOAS Results LCO, µg/l	DOAS Results TIA
1.	Inter - 0	172	4039	123	85	95	3.3	12.68	1.9	24.3	37.9	11.0	4.3	1.6
7.		64	2948	154	110	110	2.0	13.86	1.0	17.4	36.3	2.4	2.0	1.3
12.		105	3625	139	100	100	1.9	13.86	1.1	13.7	35.8	3.2	1.2	1.1
		114	3537	139	98	102	2.4	13.47	1.3	18.5	36.7	5.5	2.5	1.3
5.	Inter - 1.5X	20	1674	549	400	420	2.6	13.17	0.7	8.1	15.7	13.0	10.1	2.0
11.		53	2090	665	510	515	1.6	14.04	1.2	5.0	12.4	2.9	1.2	1.1
17.		46	1723	592	563	575	1.6	14.04	0.9	5.0	10.7	2.0	0.8	0.9
		40	1829	602	491	503	1.9	13.75	0.9	6.0	12.9	6.0	4.0	1.3
8.	Inter - 3X	80	2636	1270	1038	1063	2.8	13.17	1.1	3.7	15.7	1.5	1.1	1.0
13.		106	3135	1216	1063	1075	2.5	13.34	1.0	3.1	11.5	1.6	1.1	1.0
20.		67	2413	1367	1063	1075	2.4	13.17	1.0	3.7	13.2	0.8	1.4	1.1
		84	2728	1284	1055	1071	2.6	13.23	1.0	3.5	13.5	1.3	1.2	1.0
2.	High - 0	30	992	132	115	120	2.8	13.01	0.6	3.7	9.9	3.0	2.3	1.4
14.		19	362	192	150	155	2.0	13.86	0.7	2.5	10.7	1.8	0.8	0.9
19.		48	477	177	130	135	2.5	13.51	0.6	3.1	8.2	3.9	2.2	1.3
		32	610	167	132	137	2.4	13.46	0.6	3.1	9.6	2.9	1.8	1.2
6.	High - 1.5X	80	442	1324	1125	1163	3.8	13.68	2.0	6.9	14.0	5.0	6.1	1.8
15.		20	385	1445	1238	1250	2.0	13.68	2.7	14.3	20.6	0.8	6.0	1.8
21.		15	362	1334	1013	1025	2.3	13.51	2.1	14.3	16.5	0.4	0.8	0.9
		38	396	1368	1125	1146	2.7	13.62	2.3	11.8	17.0	2.1	4.3	1.5
4.	High - 3X	46	1269	3230	3030	3110	1.8	13.86	3.4	16.2	28.0	3.2	2.4	1.4
10.		58	1626	3203	2956	3062	1.5	14.04	2.8	10.7	19.3	2.4	2.2	1.3
16.		48	2507	2599	2313	2425	1.8	14.40	2.4	7.4	17.3	3.2	0.8	0.9
		51	1801	3011	2766	2866	1.7	14.10	2.9	11.4	21.5	2.9	1.8	1.2
3.	Idle	576	6040	95	67	70	3.9	12.37	7.8	7.4	28.9	43.8	14.3	2.2
9.		588	4790	95	70	73	3.3	12.84	4.7	5.6	23.9	28.4	10.0	2.0
18.		512	5015	110	71	72	3.3	12.68	4.6	6.2	23.1	17.7	5.9	1.8
		559	5282	100	69	72	3.5	12.63	5.7	6.4	25.3	30.0	10.1	2.0
A.	Cold Start	12,800	-	36	20	20	6.5	11.46						

TABLE D-31. COMPARISON OF GASEOUS EMISSIONS
Chrysler Gas Turbine

Condition	Load	Date	HC, ppm	CO, ppm	NO, ppm	NO_x, ppm	CO_2, %
			Observed				
1272 rpm(1)	0	9-23-74	25.5	58.2	9.0	9.2	0.77
		9-25-74	29.5	38.9	7.2	7.2	0.75
		9-27-74	32.6	24.3	8.7	9.0	0.76
		Average	29.2	40.5	8.3	8.5	0.76
1272 rpm 53.1 km/hr	1.5X	9-23-74	19.8	42.2	12.5	13.0	1.00
		9-25-74	18.2	26.2	11.8	12.3	1.01
		9-27-74	28.5	17.5	14.4	15.5	1.02
		Average	22.2	28.6	12.9	13.6	1.01
1272 rpm 53.1 km/hr	3X	9-23-74	15.0	28.0	17.0	18.0	1.14
		9-25-74	15.0	17.1	17.0	17.7	1.11
		9-27-74	24.7	13.7	22.0	22.3	1.20
		Average	18.2	19.6	18.7	19.3	1.15
2120 rpm	0	9-23-74	31.5	35.7	14.2	14.6	1.06
		9-25-74	17.0	19.4	13.7	14.2	1.04
		9-27-74	21.4	15.0	18.3	18.8	1.13
		Average	23.3	23.4	15.4	15.9	1.08
2120 rpm 90.1 km/hr	1.5X	9-23-74	24.0	16.7	36.0	37.0	1.42
		9-25-74	17.5	8.3	36.2	36.5	1.44
		9-27-74	35.3	8.6	43.2	43.3	1.44
		Average	25.6	11.2	38.5	38.9	1.43
2120 rpm 90.1 km/hr	3X	9-23-74	53.7	14.7	60.0	62.0	1.70
		9-25-74	39.5	6.4	63.8	64.3	1.67
		9-27-74	63.2	7.3	77.3	78.3	1.74
		Average	52.1	9.5	67.0	68.2	1.70
Idle		9-23-74	32.8	75.3	6.7	7.0	0.71
		9-25-74	41.2	47.9	8.0	8.0	0.70
		9-27-74	31.8	31.4	7.3	7.4	0.72
		Average	35.3	51.5	7.3	7.5	0.71
Hot Start		9-23-74	30.8	73.1	6.5	6.7	0.71
		9-25-74	34.8	47.0	6.2	6.3	0.70
		9-27-74	34.0	28.0	8.2	8.3	0.72
		Average	33.2	49.4	7.0	7.1	0.71
Cold Start		9-25-74	376.0	93.4	-	10.0	2.07
		9-27-74	320.0	110.0	-	17.0	2.17
		Average	348.0	101.7		13.5	2.12
			Background				
Air Intakes		9-23-74	2.0	4.3		0.3	0.03
		9-25-74	3.6	3.05		0.2	0.03
		9-27-74	11.6	2.2		0.7	0.07
		Average	5.7	3.2		0.4	0.04

(1)Power Turbine.

TABLE D-32. SUMMARY OF GASEOUS EMISSIONS MEASUREMENTS

Vehicle: Chrysler Gas Turbine
Date: September 23, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm Observed	NO, ppm	NO_x, ppm	CO_2, %
10.	Inter - 0	28.5	68.8	11.5	11.5	0.74
12.		16.0	44.5	8.5	9.0	0.85
25.		32.0	61.4	7.0	7.0	0.73
		25.5	58.2	9.0	9.2	0.77
2.	Inter - 2X	-	-	-	-	-
8.		14.0	41.7	12.5	13.0	1.00
17.		25.5	42.6	12.5	13.0	0.99
		19.8	42.2	12.5	13.0	1.00
4.	Inter - 4X	-	-	-	-	-
11.		11.0	23.8	18.0	19.0	1.17
22.		19.0	32.3	16.0	17.0	1.11
		15.0	28.0	17.0	18.0	1.14
9.	High - 0	15.5	35.1	13.0	13.5	1.02
16.		28.5	37.9	13.0	13.5	1.03
18.		19.0	34.2	16.5	17.0	1.14
		31.5	35.7	14.2	14.6	1.06
3.	High - 2X	-	-	-	-	-
13.		20.0	16.2	36.5	37.5	1.44
24.		28.0	17.2	35.5	36.5	1.40
		24.0	16.7	36.0	37.0	1.42
6.	High - 4X	45.0	17.2	59.5	61.0	1.70
15.		59.0	13.4	59.5	61.5	1.72
20.		57.0	13.4	61.0	63.5	1.69
		53.7	14.7	60.0	62.0	1.70
7.	Idle	30.0	79.9	7.0	7.5	0.71
19.		28.5	70.6	6.5	7.0	0.72
21.		40.0	75.3	6.5	6.5	0.70
		32.8	75.3	6.7	7.0	0.71
5.	Hot Start	26.5	77.1	6.5	7.0	0.74
14.		36.5	76.2	6.0	6.0	0.69
23.		29.5	66.0	7.0	7.0	0.72
		30.8	73.1	6.5	6.7	0.71
1.	Cold Start	-	-	-	-	-
		Background				
10A.	Air Intakes	0.5	6.7		0.4	0.03
25A.		3.5	1.9		0.2	0.03
		2.0	4.3		0.3	0.03

TABLE D-33. SUMMARY OF GASEOUS EMISSIONS MEASUREMENTS

Vehicle: Chrysler Gas Turbine
Date: September 25, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm	NO, ppm	NO_x, ppm	CO_2, %
			Observed			
9.	Inter - 0	36.5	47.3	6.5	6.5	0.72
16.		22.0	33.2	8.0	8.0	0.81
20.		30.0	36.1	7.0	7.0	0.74
		29.5	38.9	7.2	7.2	0.75
4.	Inter - 2X	19.0	28.5	12.0	12.0	0.98
14.		19.0	26.3	12.0	13.0	1.05
21.		16.5	23.8	11.5	12.0	1.00
		18.2	26.2	11.8	12.3	1.01
6.	Inter - 4X	13.0	19.0	16.0	16.5	1.09
17.		13.0	16.2	17.0	17.5	1.14
24.		19.0	16.2	18.0	19.0	1.11
		15.0	17.1	17.0	17.7	1.11
8.	High - 0	15.5	20.0	14.0	14.5	1.05
15.		17.5	21.9	13.0	13.0	1.04
25.		18.0	16.2	14.0	15.0	1.03
		17.0	19.4	13.7	14.2	1.04
2.	High - 2X	-	7.6	41.0	41.0	1.54
11.		13.5	8.6	33.5	34.0	1.42
19.		21.5	8.6	34.0	34.5	1.38
		17.5	8.3	36.2	36.5	1.44
3.	High - 4X	38.5	6.7	61.5	62.0	1.66
12.		47.0	6.7	58.0	59.0	1.70
22.		43.0	5.7	72.0	72.0	1.66
		39.5	6.4	63.8	64.3	1.67
7.	Idle	30.0	42.6	12.0	12.0	0.73
13.		55.0	52.0	6.0	6.0	0.69
18.		38.5	49.2	6.0	6.0	0.70
		41.2	47.9	8.0	8.0	0.70
5.	Hot Start	26.0	48.3	6.5	7.0	0.72
10.		39.0	52.0	6.0	6.0	0.70
23.		39.5	40.8	6.0	6.0	0.68
		34.8	47.0	6.2	6.3	0.70
1.	Cold Start	376.0	93.4	-	10.0	2.07
			Background			
5A.	Air Intakes	3.0	2.87		0	0.03
10A.		3.0	2.87		0	0.03
15A.		4.5	3.82		0.5	0.03
20A.		3.5	3.82		0	0.04
25A.		4.0	1.91		0.5	0.04
		3.6	3.05		0.2	0.03

TABLE D-14 SUMMARY OF GASEOUS EMISSIONS MEASUREMENTS

Vehicle: Chrysler Gas Turbine
Date: September 27, 1974

Run No.	Operating Condition	HC, ppm	CO, ppm Observed	NO, ppm	NO_x, ppm	CO_2, %
2.	Inter - 0	-	-	-	-	-
15.		17.5	26.6	8.5	9.0	0.75
17.		25.6	21.9	8.9	9.0	0.77
		32.6	24.3	8.7	9.0	0.76
10.	Inter - 2X	28.5	19.1	11.8	15.0	1.00
19.		24.0	16.2	19.2	15.5	1.03
25.		33.0	17.2	14.2	16.0	1.02
		28.5	17.5	14.4	15.5	1.02
5.	Inter - 4X	19.5	11.4	20.0	20.5	1.18
16.		24.0	14.3	24.0	24.3	1.29
23.		30.5	11.4	21.9	22.0	1.20
		24.7	11.7	22.0	22.3	1.20
9.	High - 0	27.3	17.2	16.0	17.0	1.04
11.		14.0	11.4	19.2	19.3	1.17
18.		23.0	14.1	19.6	19.8	1.17
		21.4	15.0	18.3	18.8	[illegible]
3.	High - 2X	20.5	8.6	45.0	45.0	1.45
14.		44.5	8.6	44.2	44.5	1.47
24.		40.9	8.6	40.5	40.5	1.40
		35.3	8.6	43.2	43.3	1.44
7.	High - 4X	58.0	7.6	76.0	76.0	1.69
12.		70.0	7.6	74.5	76.0	1.77
21.		61.6	6.7	81.5	83.0	1.76
		63.2	7.3	77.3	78.3	1.74
6.	Idle	28.5	34.2	7.0	7.1	0.72
8.		43.0	32.	7.6	7.8	0.71
20.		23.8	27.6	7.3	7.3	0.74
		31.8	31.4	7.3	7.4	0.72
4.	Hot Start	24.0	30.0	8.0	8.5	0.70
13.		41.0	30.0	7.5	8.0	0.71
22.		36.0	25.0	9.0	8.5	0.76
		34.0	28.0	8.2	8.3	0.72
1.	Cold Start	320.0	110.0	-	17.0	2.17
			Background			
5A.	Air Intakes	7.0	2.0		1.0	0.07
10A.		8.0	2.0		1.0	0.07
15A.		15.5	2.5		0.8	0.07
20A.		12.8	2.5		0.6	0.06
25A.		14.5	2.0		0.2	0.07
		11.6	2.2		0.7	0.07

APPENDIX E

DOAS DATA TAKEN DURING ODOR TESTS

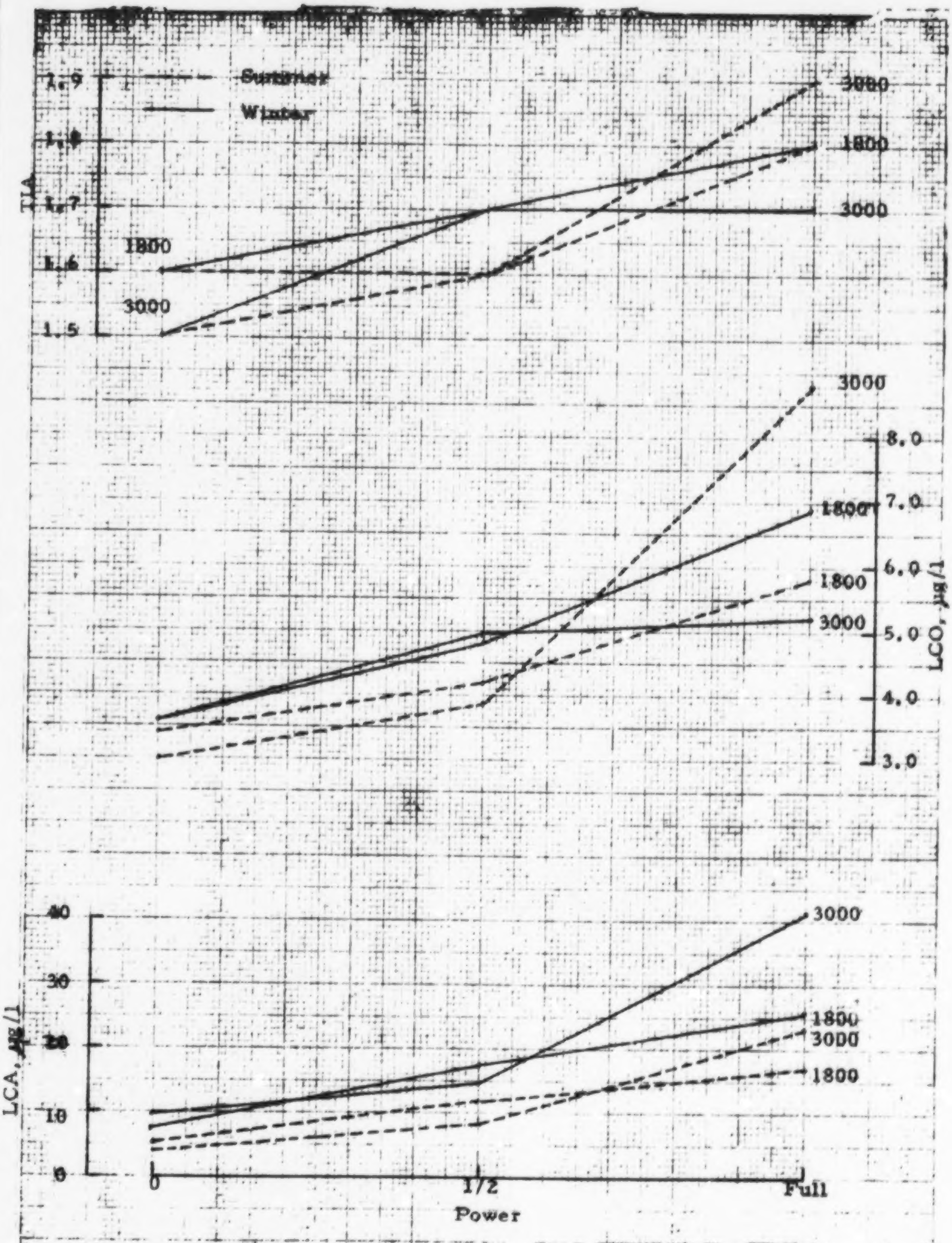

FIGURE E-1. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS
NISSAN (DATSUN) DIESEL LDV

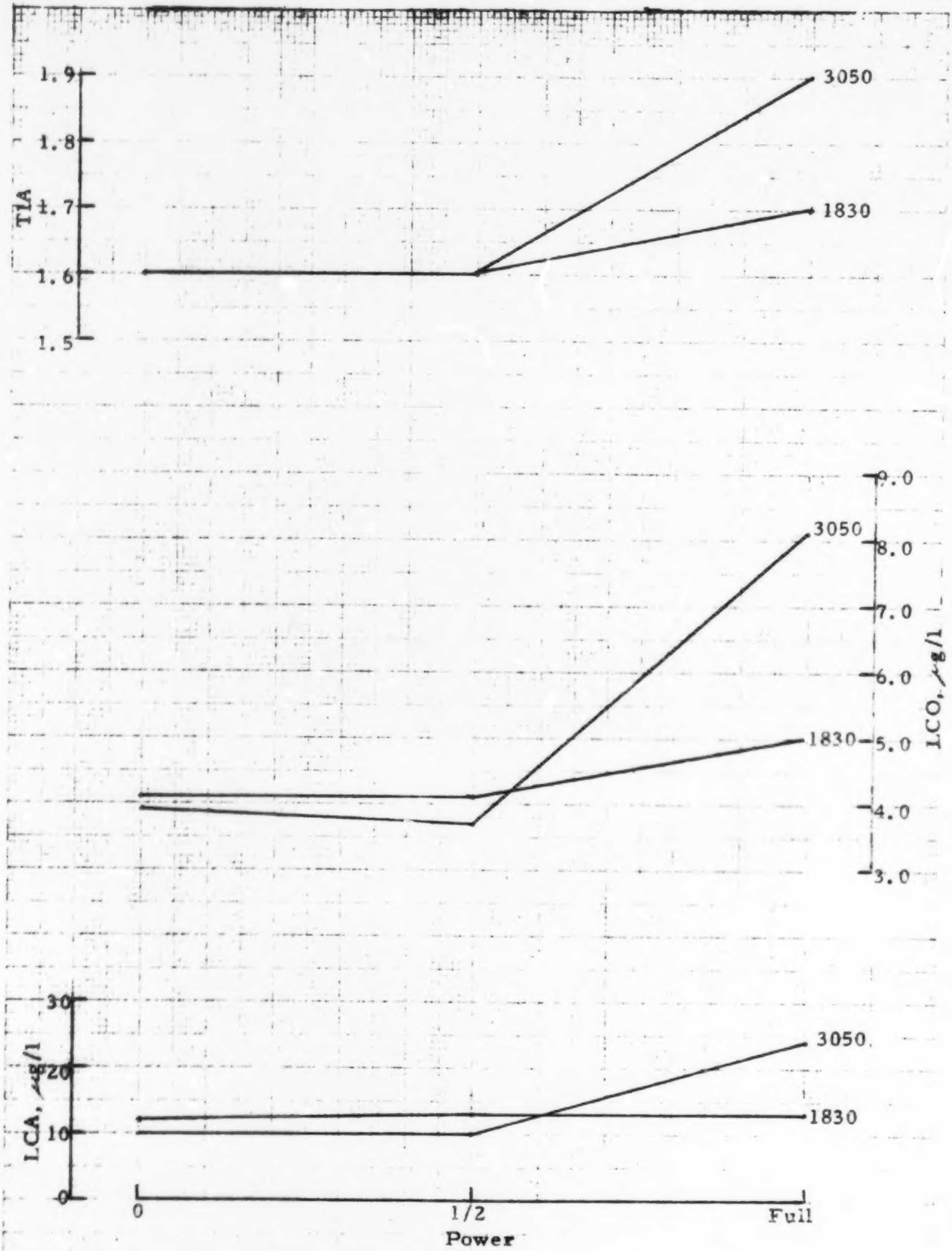

FIGURE E-2. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS MERCEDES DIESEL LDV

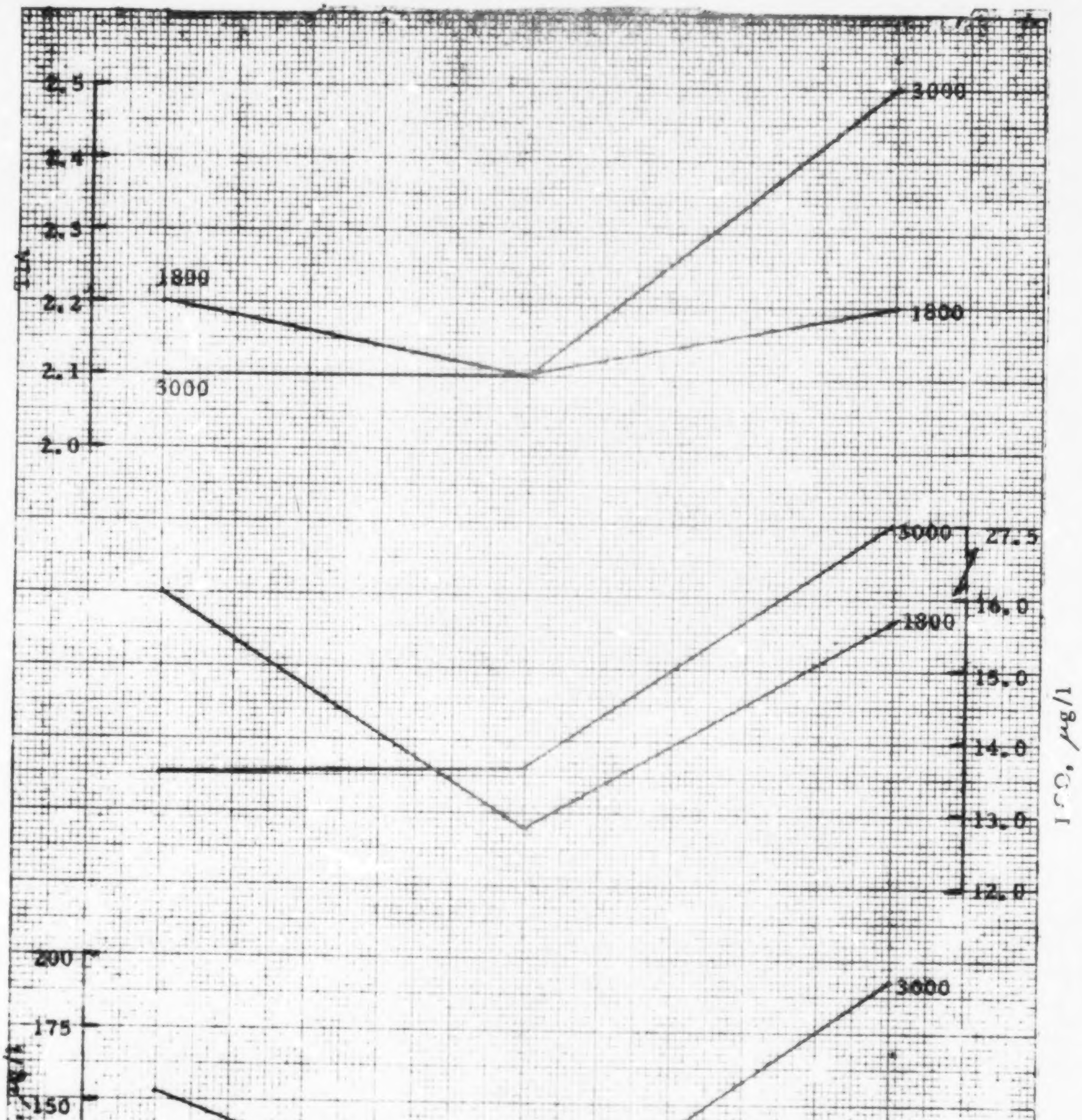

FIGURE E-3. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS PEUGEOT DIESEL LDV

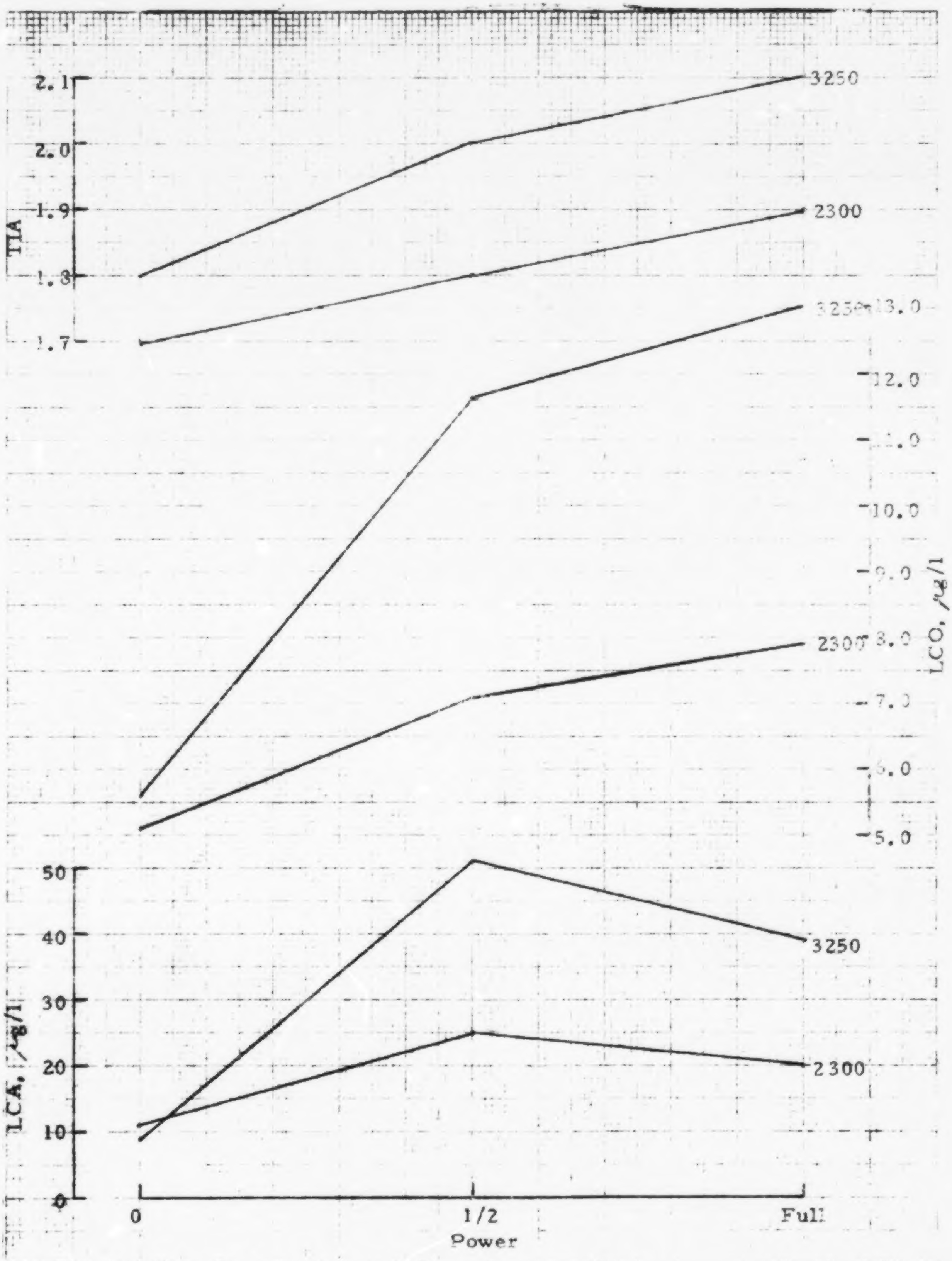

FIGURE E-4. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS
OPEL DIESEL LDV

Reproduced from best available copy.

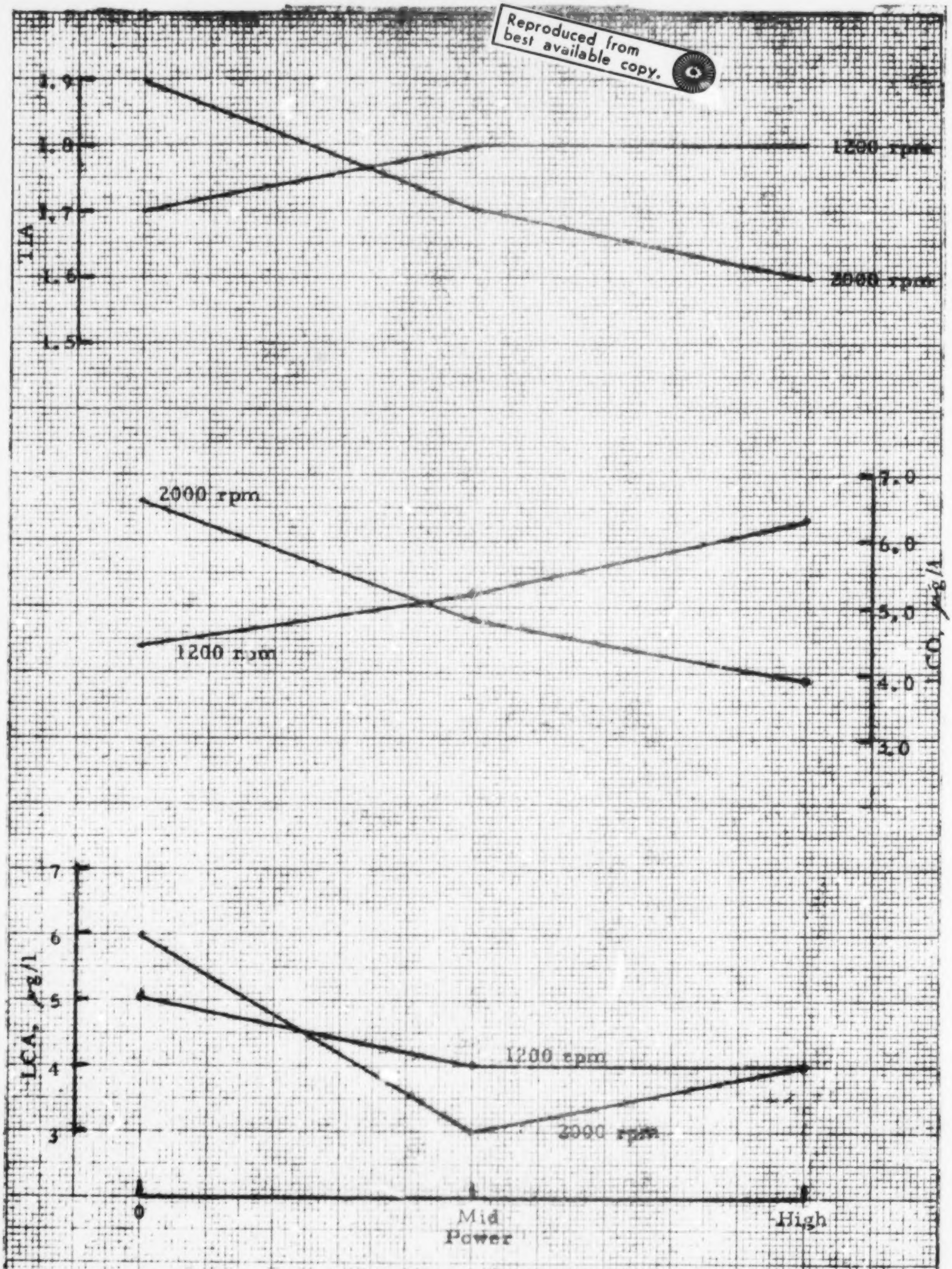

FIGURE E-5. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS FORD LTD GASOLINE LDV

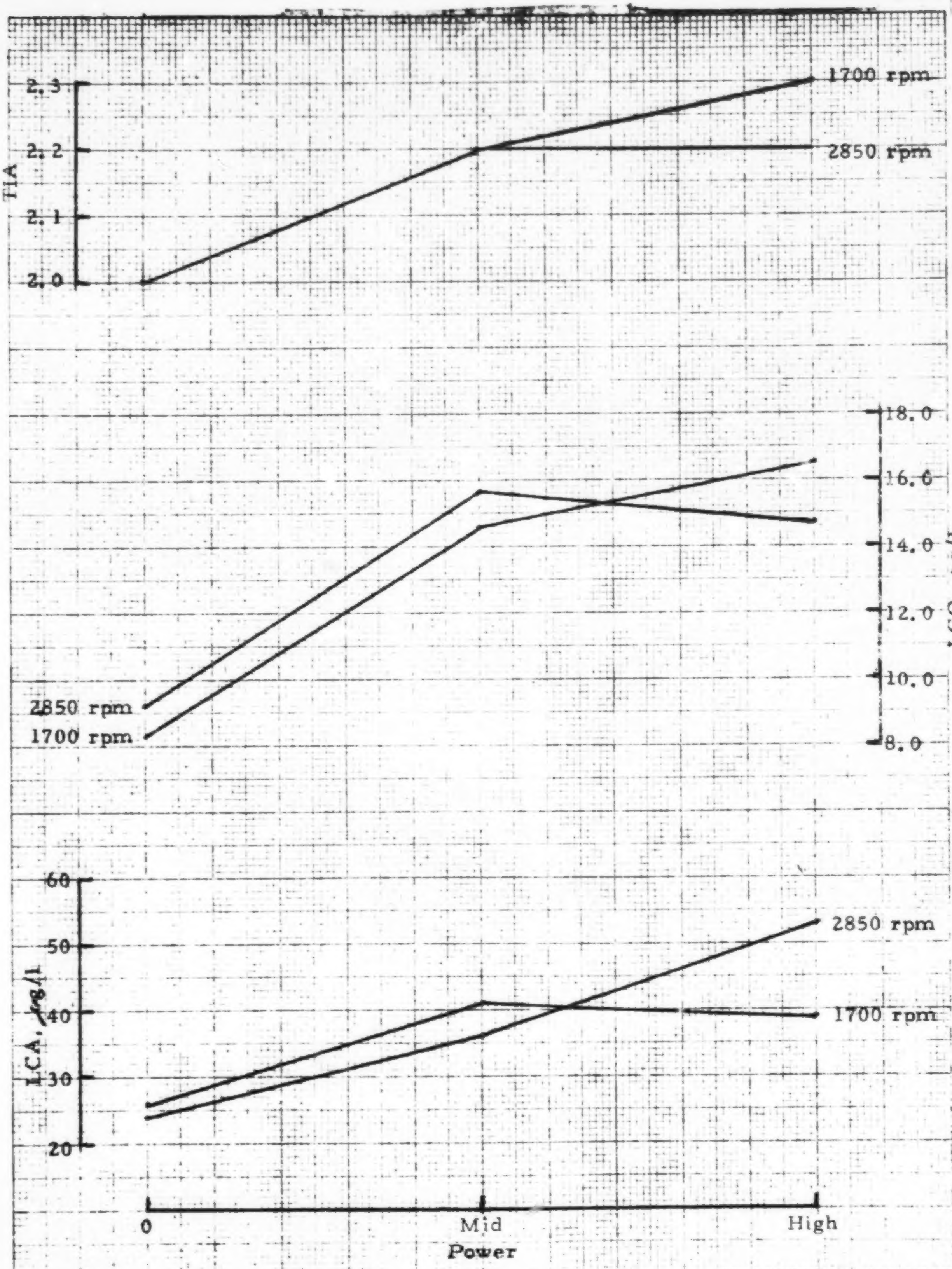

FIGURE E-6. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS CAPRI GASOLINE LDV

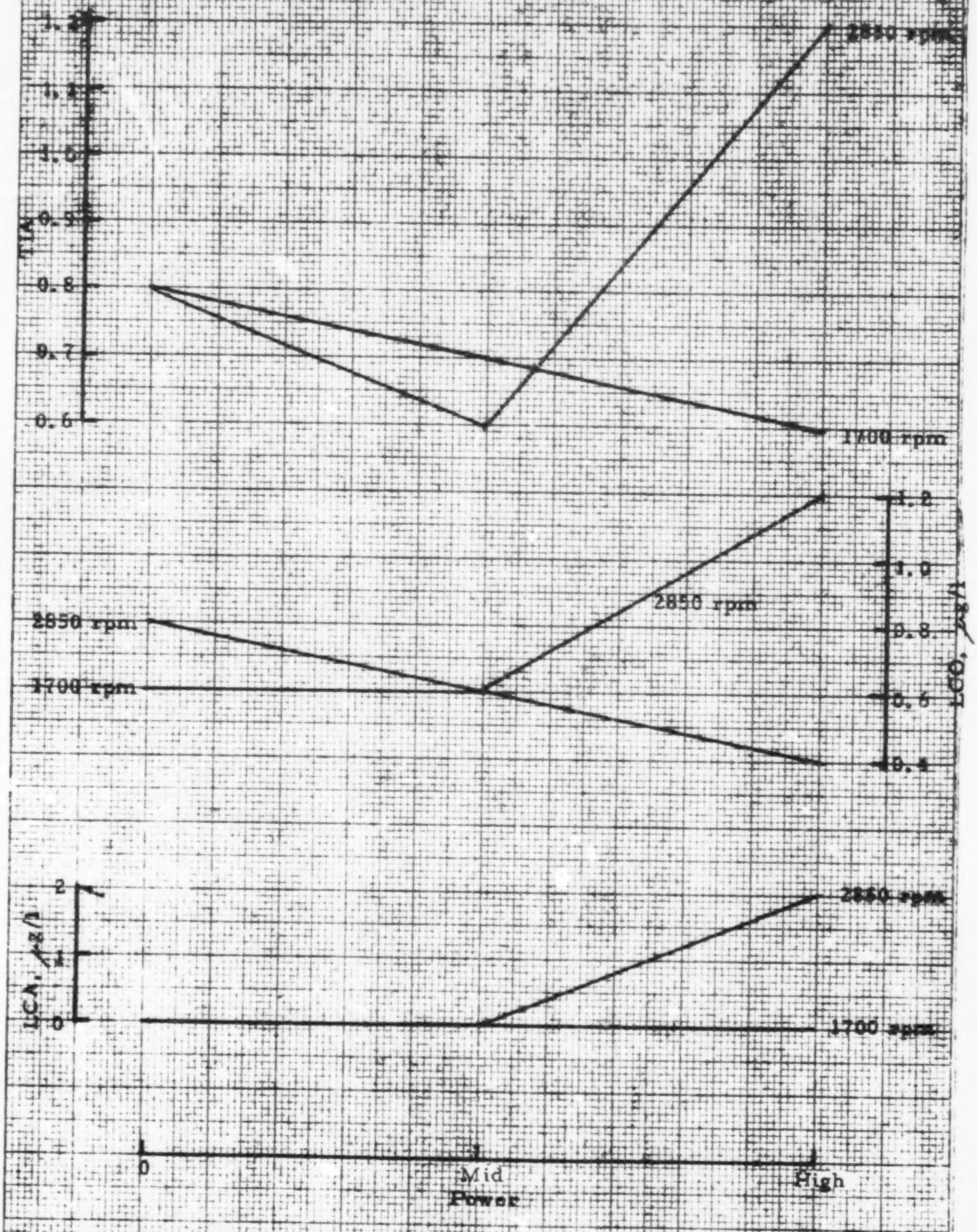

FIGURE E-7. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS
CAPRI PROCO LDV

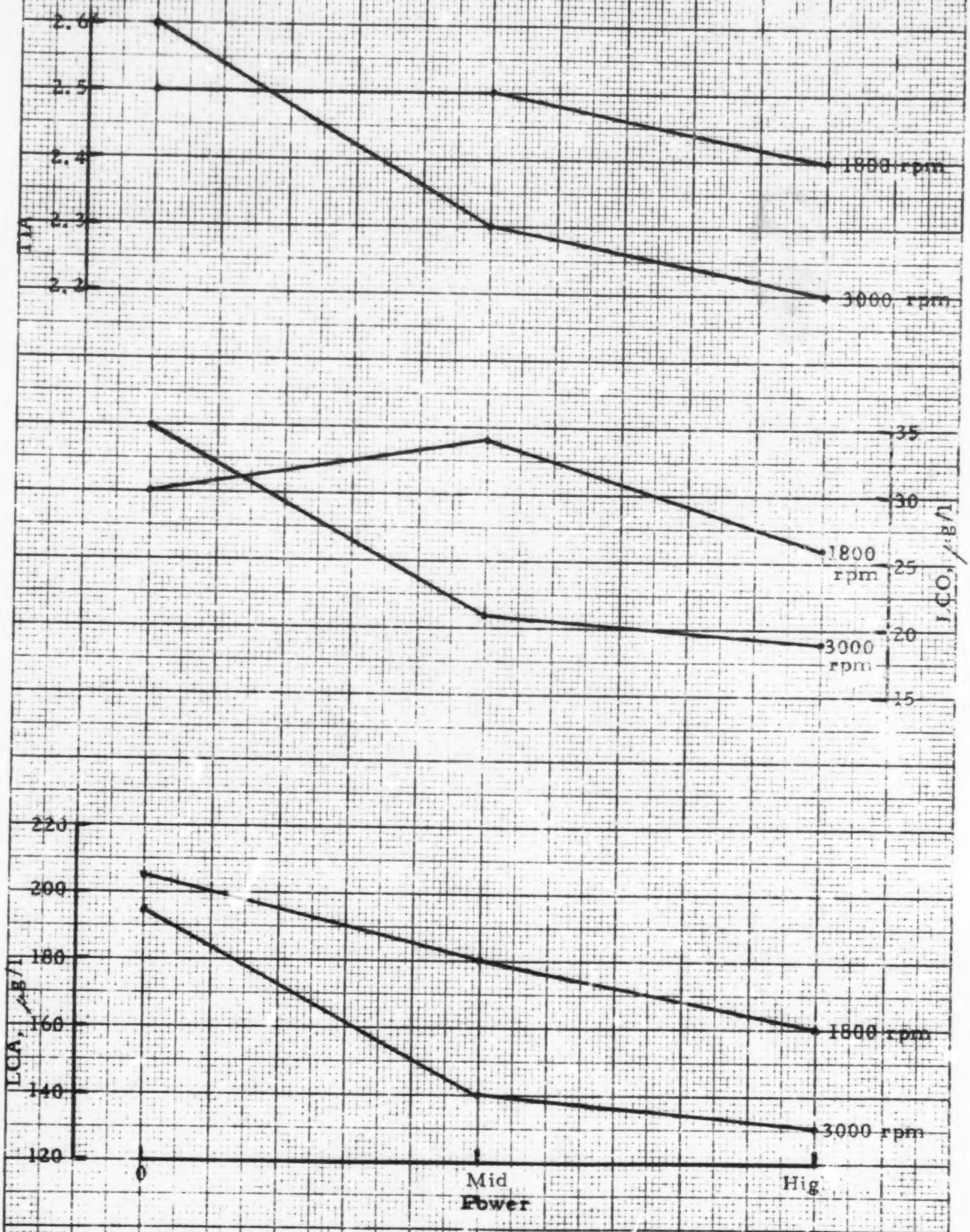

FIGURE E-8. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS
TEXACO TCCS POWERED PLYMOUTH CRICKET - DIESEL FUEL

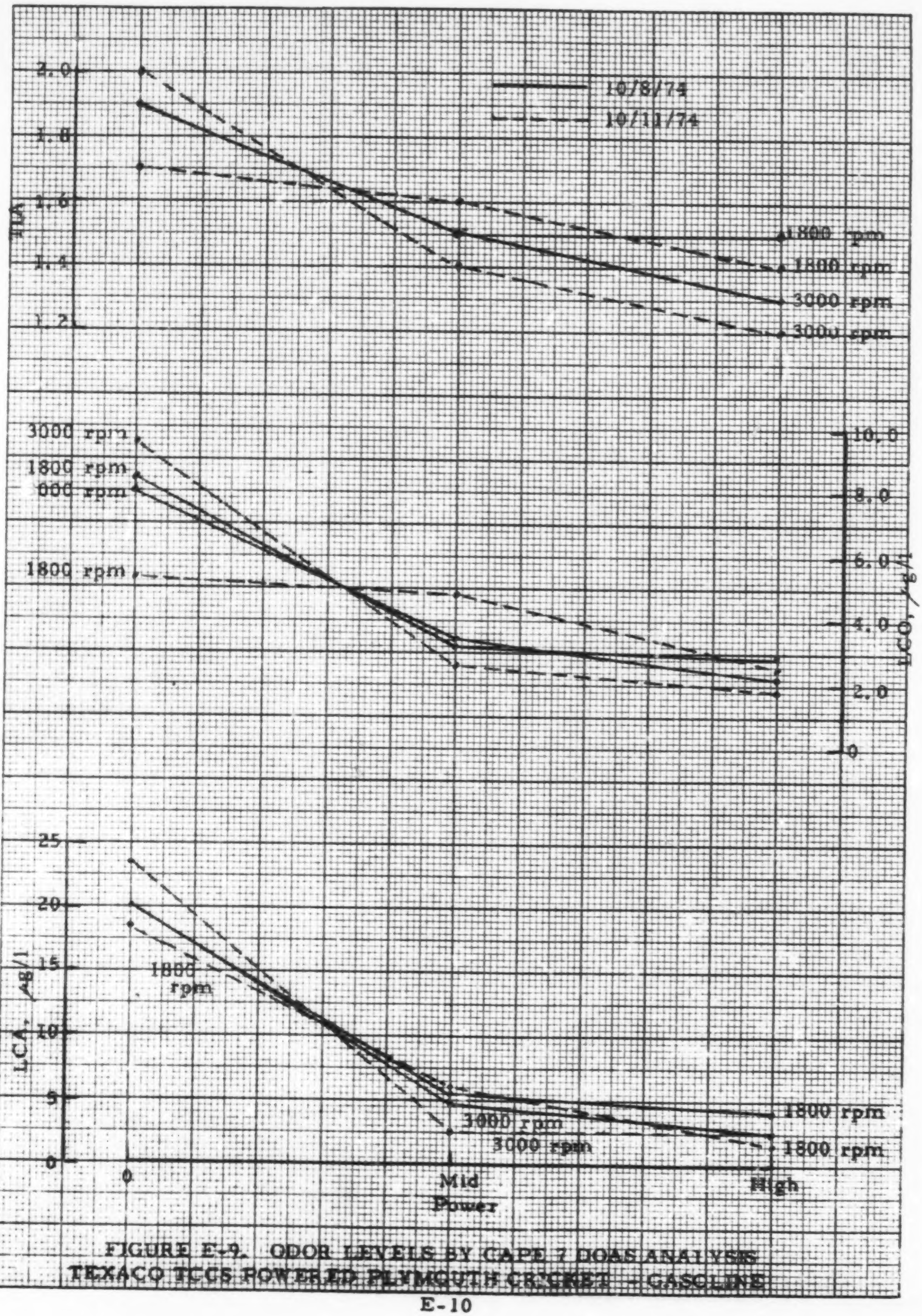

FIGURE E-9. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS TEXACO TCCS POWERED PLYMOUTH CRICKET - GASOLINE

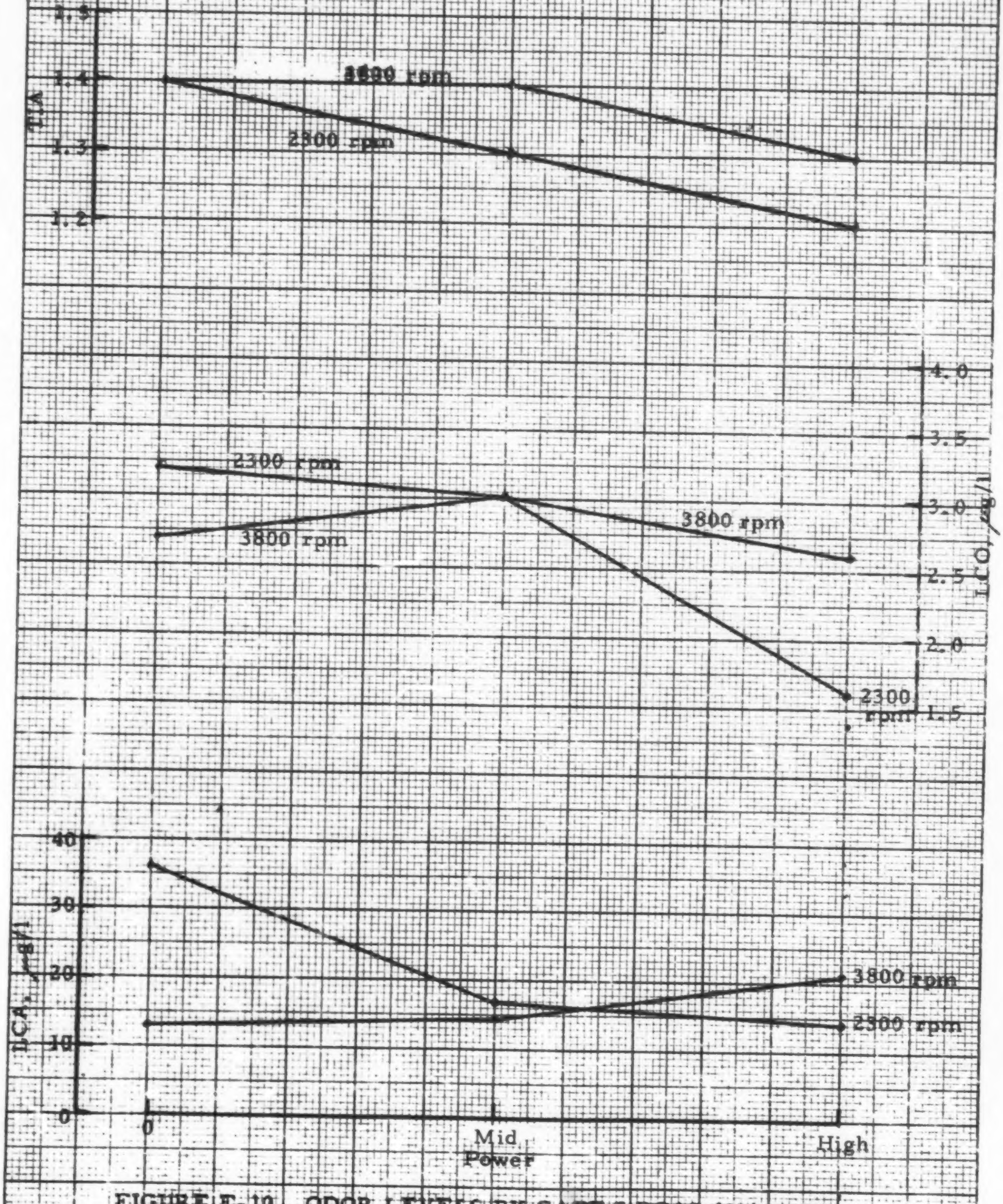

FIGURE E-10. ODOR LEVELS BY CAPE 7 DOAS ANALYSIS
HONDA CVCC CIVIC LDV

APPENDIX F

DOAS AND OXYGENATE DATA TAKEN DURING 1975 LD FTP

TABLE F-1. 1975 FTP DIESEL ODOR ANALYSIS SYSTEM RESULTS

	Diesel Fueled					Gasoline Fueled		
Test	Nissan	Mercedes	Peugeot	Opel	TCCS	PROCO	TCCS	Honda
				TIA				
1	0.9	0.7	1.2	0.7	1.2	0.3	0.5	0.3
2	0.8	0.8	1.3	0.7	1.2	0.5	0.5	0.3
3	ND***	0.7	1.2	0.9	1.4	0.3	0.5	0.3
4	1.0	0.8	1.2	0.7	-	0.3	-	-
Avg.	0.9	0.8	1.2	0.8	1.3	0.4	0.5	0.3
				LCO, μg/l				
1	0.8	0.5	1.6	0.5	1.5	0.2	0.3	0.2
2	0.6	0.6	1.8	0.6	1.6	0.3	0.3	0.2
3	ND***	0.5	1.5	0.7	1.8	0.2	0.3	0.2
4	1.0	0.6	1.5	0.5	-	0.2	-	-
Avg.	0.8	0.6	1.6	0.6	1.6	0.2	0.3	0.2
				LCA*, μg/l				
1	7.5	2.0	24.1	3.3	25.4	0.5	4.1	4.5
2	6.4	4.7	28.7	3.1	27.1	0.5	2.1	5.4
3	ND***	4.0	20.3	6.4	27.0	0.3	2.9	3.8
4	12.1	6.2	23.5	4.7	-	0.3	-	-
Avg.	8.7	4.2	24.2	4.4	26.5	0.4	3.0	4.5

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*Based on ADL LCA calibration.

**Summer configuration.

***No data, trap leaked.

APPENDIX G

CORRELATION OF DOAS WITH ODOR PANEL

TABLE G-1. PREDICTED "D" VALUES WITH OBSERVED DOAS VALUES (DATSUN)

No.	Vehicle Condition	Date	Observed DOAS Value LCA,* $\mu g/l$	LCO, $\mu g/l$	TIA	SwRI Panel "D"	Predicted "D" by Equation 1	2	3
1	Idle - 1200 rpm	1/8/74(w)	7	3.5	1.5	2.9	2.8	2.8	2.7
2	0% load - 1800 rpm	1/8/74(w)	9	3.7	1.6	3.1	3.1	3.0	3.1
3	50% load - 1800 rpm	1/8/74(w)	18	4.8	1.7	2.8	3.4	3.3	3.4
4	100% load - 1800 rpm	1/8/74(w)	26	6.9	1.8	3.8	3.8	3.6	3.6
5	0% load - 3000 rpm	1/8/74(w)	10	3.7	1.5	2.4	2.8	2.8	2.7
6	50% load - 3000 rpm	1/8/74(w)	14	5.0	1.7	3.7	3.4	3.3	3.4
7	100% load - 3000 rpm	1/8/74(w)	42	5.2	1.7	4.8	3.4	3.4	3.7
8	Idle - 1200 rpm	1/10/74(s)	4	2.8	1.4	2.7	2.5	2.5	2.4
9	0% load - 1800 rpm	1/10/74(s)	6	3.5	1.6	3.1	3.1	3.0	3.1
10	50% load - 1800 rpm	1/10/74(s)	12	4.3	1.6	3.0	3.1	3.0	3.0
11	100% load - 1800 rpm	1/10/74(s)	17	5.8	1.8	3.7	3.8	3.5	3.7
12	0% load - 3000 rpm	1/10/74(s)	5	3.0	1.5	2.1	2.8	2.8	2.7
13	50% load - 3000 rpm	1/10/74(s)	8	3.9	1.6	3.1	3.1	3.0	3.0
14	100% load - 3000 rpm	1/10/74(s)	24	8.9	1.9	3.9	4.1	3.8	3.7

---

* Based on ADL LCA standard.

Equation 1: "D" = -2.0 + 3.2 (TIA)

Equation 2: "D" = -0.69 + 2.3 (TIA) + 0.0045 (LCA)

Equation 3: "D" = -2.9 + 4.0 (TIA) + 0.012 (LCA) - 0.14 (LCO)

Note: Equations 2 and 3, use LCA and LCO concentrations in $\mu g/l$.

TABLE G-2. PREDICTED "D" VALUES WITH OBSERVED DOAS VALUES (MERCEDES)

No.	Vehicle Condition	Date	Observed DOAS Value			SwRI Panel "D"	Predicted "D" by Equation		
			LCA,* µg/l	LCO, µg/l	TIA		1	2	3
1	Idle - 800 rpm	1/15/74	14	4.0	1.6	3.1	3.1	3.1	3.1
2	0% load - 1830 rpm	1/15/74	13	4.3	1.6	2.7	3.1	3.0	3.1
3	50% load - 1830 rpm	1/15/74	13	4.1	1.6	2.5	3.1	3.0	3.1
4	100% load - 1830 rpm	1/15/74	16	6.0	1.7	3.5	3.4	3.3	3.2
5	0% load - 3050 rpm	1/15/74	10	4.2	1.6	2.3	3.1	3.0	3.0
6	50% load - 3050 rpm	1/15/74	9	4.0	1.6	3.2	3.1	3.0	3.0
7	100% load - 3050 rpm	1/15/74	26	8.8	1.9	3.7	4.1	3.8	3.8
8	Idle - 800 rpm	1/17/74	11	3.2	1.5	3.1	2.8	2.8	2.8
9	0% load - 1830 rpm	1/17/74	10	3.8	1.6	2.5	3.1	3.0	3.1
10	50% load - 1830 rpm	1/17/74	13	4.0	1.5	2.7	2.8	2.8	2.7
11	100% load - 1830 rpm	1/17/74	10	3.9	1.6	3.3	3.1	3.0	3.1
12	0% load - 3050 rpm	1/17/74	10	3.5	1.5	2.8	2.8	2.8	2.7
13	50% load - 3050 rpm	1/17/74	11	3.4	1.5	2.9	2.8	2.8	2.8
14	100% load - 3050 rpm	1/17/74	22	7.4	1.8	4.1	3.8	3.5	3.5

---

* Based on ADL LCA standard.

Equation 1: "D" = -2.0 + 3.2 (TIA)

Equation 2: "D" = -0.69 + 2.3 (TIA) + 0.0045 (LCA)

Equation 3: "D" = -2.9 + 4.0 (TIA) + 0.012 (LCA) - 0.14 (LCO)

Note: Equations 2 and 3, use LCA and LCO concentrations in µg/l.

TABLE G-3. PREDICTED "D" VALUES WITH OBSERVED DOAS VALUES (PEUGEOT)

No.	Vehicle Condition	Date	Observed DOAS Value LCA,* µg/l	 LCO, µg/l	 TIA	SwRI Panel "D"	Predicted "D" by Equation 1	 2	 3
1	Idle - 750 rpm	3/5/74	59	8.9	1.9	4.8	4.1	3.9	4.2
2	0% load - 1800 rpm	3/5/74	120	13.9	2.1	6.2	4.7	4.7	5.0
3	50% load - 1800 rpm	3/5/74	119	13.3	2.1	4.4	4.7	4.7	5.1
4	100% load - 1800 rpm	3/5/74	97	12.0	2.0	4.7	4.4	4.3	4.6
5	0% load - 3000 rpm	3/5/74	143	12.1	2.1	6.3	4.7	4.8	5.5
6	50% load - 3000 rpm	3/5/74	92	11.6	2.1	4.9	4.7	4.6	5.0
7	100% load - 3000 rpm	3/5/74	189	25.6	2.4	5.9	5.7	5.7	5.4
8	Idle - 750 rpm	3/7/74	66	10.6	2.0	4.7	4.4	4.2	4.4
9	0% load - 1800 rpm	3/7/74	148	18.0	2.2	5.7	5.0	5.0	5.2
10	50% load - 1800 rpm	3/7/74	105	12.1	2.1	3.7	4.7	4.6	5.1
11	100% load - 1800 rpm	3/7/74	158	19.3	2.2	4.6	5.0	5.1	5.1
12	0% load - 3000 rpm	3/7/74	163	14.8	2.1	5.7	4.7	4.9	5.4
13	50% load - 3000 rpm	3/7/74	119	15.4	2.1	4.4	4.7	4.7	4.8
14	100% load - 3000 rpm	3/7/74	198	29.4	2.5	5.2	6.0	6.0	5.4

---

* Based on ADL LCA standard.

Equation 1: "D" = -2.0 + 3.2 (TIA)

Equation 2: "D" = -0.69 + 2.3 (TIA) + 0.0045 (LCA)

Equation 3: "D" = -2.9 + 4.0 (TIA) + 0.012 (LCA) - 0.14 (LCO)

Note: Equations 2 and 3, use LCA and LCO concentrations in µg/l.

TABLE G-4. PREDICTED "D" VALUES WITH OBSERVED DOAS VALUES (OPEL)

No.	Vehicle Condition	Date	Observed DOAS Value			SwRI Panel "D"	Predicted "D" by Equation		
			LCA,* µg/l	LCO, µg/l	TIA		1	2	3
1	Idle - 600 rpm	3/19/74	19	5.7	1.8	3.5	3.8	3.5	3.7
2	0% load - 1950	3/19/74	16	5.8	1.7	3.5	3.4	3.3	3.3
3	50% load - 2300 rpm	3/19/74	35	8.6	1.9	4.3	4.1	3.8	3.9
4	100% load - 2550 rpm	3/19/74	22	8.4	1.9	3.6	4.1	3.8	3.8
5	0% load - 3250 rpm	3/19/74	10	5.8	1.8	3.3	3.8	3.5	3.6
6	50% load - 3360 rpm	3/19/74	66	13.9	2.1	4.8	4.7	4.4	4.3
7	100% load - 3460 rpm	3/19/74	49	16.7	2.1	3.9	4.7	4.4	3.8
8	Idle - 600 rpm	3/21/74	7	3.9	1.6	3.0	3.1	3.0	3.0
9	0% load - 1950 rpm	3/21/74	7	4.4	1.7	3.5	3.4	3.3	3.4
10	50% load - 2300 rpm	3/21/74	15	5.6	1.8	4.0	3.8	3.6	3.7
11	100% load - 2550 rpm	3/21/74	18	7.4	1.9	3.8	4.1	3.8	3.9
12	0% load - 3250 rpm	3/21/74	9	7.8	1.8	3.3	3.8	3.5	3.3
13	50% load - 3360 rpm	3/21/74	33	8.9	1.9	4.1	4.1	3.8	3.8
14	100% load - 3460 rpm	3/21/74	24	9.3	2.0	4.1	4.4	4.0	4.1

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* Based on ADL LCA standard.

Equation 1: "D" = -2.0 + 3.2 (TIA)

Equation 2: "D" = -0.69 + 2.3 (TIA) + 0.0045 (LCA)

Equation 3: "D" = -2.9 + 4.0 (TIA) + 0.012 (LCA) - 0.14 (LCO)

Note: Equations 2 and 3, use LCA and LCO concentrations in µg/l.

TABLE H-1. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Nissan Datsun Date 2-25-74 Evaluated By KH

Model Engine ____________ Run No. 1

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.3	1	4.0	1	3.5
2	6.0	2	4.5	2	3.5
3	5.0	3	4.0	3	3.3
4	5.2	4	3.5	4	3.7
5	7.0	5	3.8	5	4.0
6	4.0	6	4.0	6	3.7
7	5.0	7	4.0	7	4.0
8	5.0	8	4.6	8	3.8
9	5.0	9	4.3	9	3.8
10	5.3	10	5.2	10	4.0
11	5.8	11	5.0	11	4.5
12	6.0	12	5.0	12	4.5
13	6.0	13	5.0	13	4.7
14	6.5	14	5.0	14	5.2
15	6.5	15	5.5	15	5.5

Total Smoke % 82.6 67.4 61.7

Factor (a) = $\frac{211.7}{45}$ = 4.7 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	5.5	1	5.4	1	5.3
2	5.5	2	5.0	2	5.4
3	5.5	3	4.8	3	5.5
4	6.0	4	5.0	4	5.7
5	5.5	5	6.0	5	5.5

Total Smoke % 28.0 26.2 27.4

Factor (b) = $\frac{81.6}{15}$ = 5.4 %

Comments:		
7.0	6.0	5.7
6.5	5.5	5.5
6.5	5.2	5.5
20.0	16.7	16.7

$\frac{53.1}{9}$ 5.9 % "C" factor

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TABLE H-2. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Nissan Datsun Date 2-25-74 Evaluated By KH

Model Engine ______ Run No. 2

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.0	1	4.0	1	4.0
2	4.0	2	4.3	2	4.0
3	4.2	3	4.5	3	4.0
4	4.5	4	5.0	4	4.8
5	5.5	5	3.8	5	3.7
6	4.0	6	3.8	6	3.5
7	4.0	7	4.2	7	4.5
8	3.8	8	4.5	8	4.5
9	4.5	9	4.2	9	4.5
10	5.0	10	4.5	10	4.5
11	5.0	11	4.9	11	5.0
12	5.0	12	5.0	12	5.3
13	5.2	13	5.0	13	5.4
14	5.5	14	5.5	14	5.3
15	5.5	15	6.0	15	5.5

Total Smoke % 69.7 69.2 68.5

Factor (a) = $\frac{207.4}{45}$ = 4.6 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.5	1	6.2	1	6.0
2	4.8	2	6.0	2	5.0
3	4.5	3	6.0	3	5.5
4	5.0	4	6.0	4	5.5
5	5.0	5	6.0	5	5.5

Total Smoke % 23.8 30.2 27.5

Factor (b) = $\frac{81.5}{15}$ = 5.4 %

Comments:

5.5	6.2	6.0
5.5	6.0	5.5
5.5	6.0	5.5
16.5	18.2	17.0

$\frac{51.7}{9}$ = 5.7 % "c" factor

TABLE H-3. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Nissan Datsun Date 2-25-74 Evaluated By KH

Model Engine

Run No. 3

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	6.2	1	5.5	1	3.2
2	9.0	2	6.0	2	3.0
3	7.0	3	3.5	3	3.2
4	5.5	4	3.5	4	3.0
5	6.0	5	3.7	5	5.0
6	6.7	6	3.6	6	3.5
7	5.3	7	4.0	7	3.5
8	5.5	8	4.0	8	3.7
9	6.0	9	4.0	9	4.0
10	6.0	10	4.5	10	4.5
11	6.0	11	5.0	11	4.7
12	6.5	12	5.2	12	5.0
13	6.5	13	5.0	13	5.0
14	6.5	14	5.0	14	6.0
15	6.7	15	5.5	15	5.0

Total Smoke % 95.4 68.0 62.3

Factor (a) = $\frac{225.7}{45}$ = 5.0 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	6.5	1	6.0	1	6.0
2	6.5	2	6.0	2	6.0
3	7.0	3	6.0	3	5.5
4	7.0	4	6.0	4	5.7
5	6.5	5	5.5	5	6.3

Total Smoke % 33.5 29.5 29.5

Factor (b) = $\frac{92.5}{15}$ = 6.2 %

Comments:

9.0	6.0	6.3
7.0	6.0	6.0
7.0	6.0	6.0
23.0	18.0	18.3

$\frac{59.3}{9}$ = 6.6 % 'c' factor

TABLE H-4. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Mercedes 220D Date 1-9-74 Evaluated By KH

Model Engine ______ Run No. 1

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	2.6	1	2.8	1	4.5
2	5.5	2	4.5	2	6.4
3	4.5	3	4.0	3	5.5
4	3.0	4	2.8	4	3.7
5	2.7	5	2.6	5	3.6
6	3.4	6	3.0	6	4.0
7	2.0	7	1.5	7	2.6
8	2.0	8	1.5	8	2.6
9	2.0	9	1.5	9	2.6
10	2.1	10	1.5	10	2.8
11	2.1	11	1.5	11	2.8
12	2.3	12	1.5	12	2.8
13	2.3	13	1.5	13	3.0
14	2.3	14	1.7	14	3.0
15	2.3	15	1.8	15	3.0
Total Smoke %	41.1		33.7		52.9

Factor (a) = $\frac{127.7}{45}$ = 2.8%

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	2.2	1	2.0	1	2.8
2	2.2	2	2.0	2	2.8
3	2.1	3	2.0	3	2.8
4	2.1	4	2.0	4	2.8
5	2.3	5	2.0	5	2.8
Total Smoke %	10.9		10.0		14.0

Factor (b) = $\frac{34.9}{15}$ = 2.3%

Comments:

5.5	4.5	6.4
4.5	4.0	5.5
3.4	3.0	4.5
13.4	11.5	16.4

$\frac{41.3}{9}$ = 4.6% "c" factor

TABLE H-5. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Mercedes 220 D Date ________ Evaluated By KH

Model Engine ________ Run No. 2

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	3.5	1	3.0	1	3.2
2	5.3	2	5.5	2	5.5
3	5.0	3	6.0	3	6.0
4	4.0	4	5.0	4	4.5
5	3.6	5	3.6	5	3.6
6	5.3	6	4.0	6	3.6
7	2.5	7	2.6	7	2.8
8	2.5	8	2.6	[illegible]	3.0
9	2.5	9	2.6	9	3.0
10	2.7	10	2.6	10	3.0
11	2.7	11	3.0	11	3.0
12	2.7	12	3.2	12	3.0
13	3.0	13	3.5	13	3.2
14	3.3	14	3.5	14	3.4
15	3.3	15	3.6	15	3.5
Total Smoke %	51.9		54.3		54.3

Factor (a) = $\frac{160.5}{45}$ = 3.6 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	3.0	1	2.7	1	3.0
2	3.0	2	2.7	2	3.0
3	3.0	3	2.7	3	3.0
4	3.0	4	2.7	4	3.0
5	3.0	5	2.7	5	3.0
Total Smoke %	15.0		13.5		15.0

Factor (b) = $\frac{43.5}{15}$ = 2.9 %

Comments:

5.3	6.0	6.0
5.3	5.5	5.5
5.0	5.0	4.5
15.6	16.5	16.0

$\frac{48.1}{9}$ = 5.3 % "c" factor

TABLE H-6. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Mercedes 220D Date 1-9-74 Evaluated By KH

Model Engine ______

Run No. 3

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	5.0	1	3.8	1	5.5
2	5.2	2	6.0	2	6.2
3	4.0	3	5.6	3	5.0
4	4.0	4	4.5	4	4.0
5	4.5	5	4.2	5	3.7
6	3.0	6	5.0	6	2.1
7	3.0	7	3.0	7	2.1
8	3.0	8	3.0	8	2.1
9	3.0	9	3.0	9	2.3
10	3.0	10	3.0	10	2.5
11	3.0	11	3.1	11	3.0
12	2.9	12	3.3	12	3.0
13	2.9	13	3.5	13	3.0
14	2.9	14	3.5	14	3.0
15	2.9	15	3.5	15	3.0
Total Smoke %	52.3		58.0		50.5

Factor (a) = $\frac{160.8}{45}$ = 3.6 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	3.0	1	3.0	1	2.5
2	3.0	2	3.0	2	2.5
3	3.0	3	3.0	3	2.5
4	3.0	4	3.0	4	2.5
5	3.0	5	3.0	5	2.5
Total Smoke %	15.0		15.0		11.5

Factor (b) = $\frac{41.5}{15}$ = 2.8 %

Comments:

5.2	6.0	6.2
5.0	5.6	5.5
4.5	5.0	5.0
14.7	16.6	16.7

$\frac{48.0}{9}$ = 5.3 % "c" factor

TABLE H-7. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Peugeot Date 2/14/74 Evaluated By KH

Model Engine ______ Run No. 1

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.8	1	3.5	1	4.2
2	7.5	2	3.7	2	5.5
3	8.3	3	5.2	3	5.5
4	7.0	4	5.0	4	4.8
5	5.8	5	4.6	5	4.2
6	5.3	6	4.2	6	3.5
7	4.5	7	3.8	7	3.1
8	4.0	8	3.6	8	3.2
9	3.5	9	4.0	9	3.4
10	3.8	10	4.0	10	3.5
11	4.0	11	3.0	11	2.6
12	4.0	12	3.0	12	2.5
13	4.0	13	3.0	13	2.5
14	4.0	14	3.0	14	2.5
15	4.2	15	3.0	15	2.5

Total Smoke % 74.7 56.6 53.5

Factor (a) = $\frac{184.8}{45}$ = 4.1 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	5.6	1	5.0	1	4.0
2	5.4	2	5.0	2	4.2
3	5.3	3	5.5	3	4.2
4	5.3	4	6.0	4	4.2
5	5.3	5	6.2	5	4.0

Total Smoke % 26.9 27.7 20.6

Factor (b) = $\frac{75.2}{15}$ = 5.0 %

Comments:

8.3	6.2	5.5
7.5	6.0	5.5
7.0	5.5	4.8
22.8	17.7	15.8

$\frac{56.3}{3}$: 6.3 % "c" factor

TABLE H-8. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Peugeot Date 2/14/74 Evaluated By KH

Model Engine ________ Run No. 2

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	3.9	1	3.6	1	3.3
2	5.0	2	4.3	2	4.5
3	65	3	4.3	3	5.0
4	6.5	4	4.0	4	4.8
5	6.3	5	3.5	5	4.8
6	6.2	6	30	6	4.5
7	7.0	7	28	7	3.7
8	8.5	8	2.8	8	4.0
9	8.5	9	2.6	9	3.1
10	7.6	10	2.6	10	3.1
11	3.0	11	19	11	3 1
12	3.0	12	25	12	2 8
13	3 2	13	2.5	13	2 6
14	3.1	14	20	14	2.7
15	3.2	15	20	15	3.0

Total Smoke % 81.5 44.4 55.0

Factor (a) = $\frac{180.9}{45}$ = 4.0 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	3 8	1	3.5	1	3.5
2	4.0	2	3.5	2	3.7
3	3.9	3	4.0	3	3.6
4	3.9	4	4.0	4	4.0
5	3.8	5	4.3	5	4.3

Total Smoke % 19.4 19.3 19.1

Factor (b) = $\frac{57.8}{15}$ = 3.9 %

Comments:

8.5	4.3	4.8
8.5	4.3	4.8
7.6	4.3	5.0
24.6	12.9	14.6

$\frac{52.1}{9}$ = 5.8 % "c" factor

TABLE H-9. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Peugeot   Date 2/14/74   Evaluated By KH

Model Engine ________   Run No. 3

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.0	1	3.3	1	3.7
2	4.7	2	3.1	2	3.5
3	4.4	3	3.5	3	4.5
4	4.	4	3.5	4	4.5
5	4.4	5	3.5	5	4.5
6	4.0	6	3.4	6	4.0
7	4.0	7	3.0	7	3.5
8	4.0	8	2.5	8	3.0
9	2.5	9	2.2	9	2.5
10	2.5	10	2.2	10	2.3
11	2.5	11	2.2	11	2.3
12	2.5	12	2.2	12	2.3
13	2.5	13	2.0	13	2.3
14	2.8	14	2.0	14	2.3
15	2.0	15	2.0	15	2.2
Total Smoke %	52.2		40.6		47.4

Factor (a) = $\frac{140.2}{45}$ = 2.1 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	2.8	1	3.0	1	2.7
2	2.8	2	3.1	2	3.0
3	2.8	3	3.0	3	3.0
4	2.8	4	3.2	4	3.0
5	2.8	5	3.4	5	3.0
Total Smoke %	14.0		15.7		14.7

Factor (b) = $\frac{44.4}{15}$ = 3.0 %

Comments:

4.7	3.5	4.5
4.4	3.5	4.5
4.4	3.5	4.5
13.5	10.5	13.5

$\frac{37.5}{9}$ = 4.2 % "c" factor

TABLE H-10. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Opel

Date 2/18/74

Evaluated By KH

Model Engine

Run No. 1

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	6.5	1	6.0	1	6.3
2	7.5	2	7.0	2	5.3
3	6.0	3	5.0	3	6.2
4	4.5	4	6.0	4	6.5
5	4.0	5	7.0	5	7.5
6	4.7	6	7.5	6	9.0
7	5.0	7	5.5	7	9.2
8	5.0	8	6.0	8	8.0
9	5.5	9	5.3	9	7.0
10	6.5	10	6.0	10	7.0
11	8.0	11	6.5	11	6.8
12	10.0	12	8.0	12	6.6
13	9.0	13	8.5	13	7.5
14	7.8	14	8.0	14	10.5
15	9.0	15	9.0	15	11.0

Total Smoke % 99.0 101.2 114.4

Factor (a) = $\frac{314.7}{45}$ = 7.0%

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	10.0	1	12.5	1	10.0
2	9.5	2	13.0	2	10.5
3	9.0	3	10.5	3	9.5
4	8.8	4	9.0	4	9.5
5	11.3	5	8.5	5	9.0

Total Smoke % 48.6 53.5 48.5

Factor (b) = $\frac{150.6}{15}$ = 10.0%

Comments:

11.8	13.0	11.0
10.0	12.5	10.5
10.0	10.5	10.5
31.8	36.0	32.0

$\frac{99.8}{9}$ = 11.1% "C" factor

TABLE H-11. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Opel Date 2/18/74 Evaluated By KH

Model Engine

Run No. 2

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	6.5	1	3.5	1	6.0
2	4.8	2	6.0	2	6.1
3	3.5	3	4.0	3	5.0
4	3.0	4	4.5	4	3.8
5	4.5	5	4.5	5	3.0
6	4.0	6	3.8	6	4.3
7	3.5	7	4.0	7	5.5
8	4.7	8	3.8	8	5.5
9	5.0	9	3.6	9	4.7
10	4.3	10	4.0	10	4.3
11	4.5	11	5.0	11	4.0
12	5.0	12	6.5	12	4.0
13	5.5	13	6.0	13	5.5
14	5.5	14	6.0	14	5.5
15	6.5	15	6.3	15	6.5

Total Smoke % 70.8 71.5 73.7

Factor (a) = $\frac{216.0}{45}$ = 4.8%

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	6.5	1	7.0	1	6.2
2	6.0	2	7.5	2	6.0
3	5.5	3	7.5	3	5.8
4	5.5	4	7.0	4	5.8
5	5.5	5	7.6	5	5.5

Total Smoke % 29.0 36.6 29.3

Factor (b) = $\frac{94.9}{15}$ = 6.3%

Comments:

6.5	7.6	6.5
6.5	7.5	6.2
6.5	7.5	6.1
19.5	22.6	18.8

$\frac{60.9}{9}$ = 6.8% "c factor

TABLE H-12. SMOKEMETER OPACITY READINGS FROM CHASSIS VERSION OF FEDERAL SMOKE TEST

Vehicle No. Opel Date 2/18/74 Evaluated By KH

Model Engine ______ Run No. 3

Accelerations

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	4.0	1	5.0	1	4.0
2	8.3	2	6.0	2	6.5
3	6.7	3	4.5	3	4.8
4	5.0	4	3.5	4	3.5
5	4.0	5	2.6	5	3.0
6	6.2	6	3.5	6	3.0
7	4.5	7	3.3	7	3.0
8	4.8	8	3.0	8	3.5
9	5.1	9	3.0	9	3.0
10	5.2	10	3.0	10	3.0
11	5.0	11	3.3	11	3.0
12	7.0	12	3.0	12	3.0
13	5.5	13	4.5	13	3.3
14	5.8	14	5.0	14	3.6
15	6.0	15	4.5	15	4.3
Total Smoke %	83.1		57.7		54.5

Factor (a) = $\frac{195.2}{45}$ = 4.3 %

Lugging

First Sequence		Second Sequence		Third Sequence	
Interval No.	Smoke %	Interval No.	Smoke %	Interval No.	Smoke %
1	9.0	1	6.0	1	7.0
2	6.5	2	5.0	2	6.0
3	6.0	3	5.0	3	6.0
4	6.2	4	4.5	4	5.5
5	6.0	5	4.5	5	5.0
Total Smoke %	33.7		25.0		29.5

Factor (b) = $\frac{88.2}{15}$ = 5.9 %

Comments:

9.0	6.0	7.0
8.3	6.0	6.5
7.0	5.0	6.0
24.3	17.0	19.5

$\frac{60.8}{9}$ = 6.8 % c factor

TABLE I-1. DATSUN-NISSAN DIESEL CAR NOISE DATA - dBA SCALE

Date: March 6, 1974 Wind: 4.8 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test 40-47

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m(1)				
Right to Left	74.5	74	75	74.8
Left to Right	73	73	73.5	73.3
Interior	82	83.5	83	83.3
Fresh Air Blr On	83	84	84	84

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 40-47 After Test 40-47

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	63	63.5	63	63.3
Left to Right	63	62	62	62.5
Interior	69	68.5	70	69.5
Fresh Air Blr On	70	71.5	71	71.3

Engine Idle, Vehicle at Rest

Ambient: Before Test 40-45 After Test 40-45

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	62 (67 Blr On)				61.5 (66.5 Blr On)				67
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	79	66.5	73	72.5	79	66	74.5	72.5	79

(1) According to SAE J-986a.

(2) Average of the two highest readings that are within 2dB of each other.

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TABLE I-2. MERCEDES 220 DIESEL CAR NOISE DATA - dBA SCALE

Date: March 5, 1974 Wind: 6.4 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 45-55 After Test 45-55

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m[1]				
Right to Left	76	77	77	77
Left to Right	74	73	73	73.5
Interior	73.5	74.5	74	74.3
Fresh Air Blr On	79	78.5	78.5	78.8

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 45-55 After Test 45-55

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 7.62m				
Right to Left	62	61.5	62	62
Left to Right	62	62	62	62
Interior	62.5	64	63	63.5
Fresh Air Blr On	73	74	72.5	73.5

Engine Idle, Vehicle at Rest

Ambient: Before Test 45-55 After Test 45-55

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	51 (71.5 Blr On)				52 (71.5 Blr On)				71.5
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	66	60	66	64.5	66	59	66	64	66

[1] According to SAE J-986a.

[2] Average of the two highest readings that are within 2dB of each other.

TABLE I-3. CAPRI DIESEL CAR NOISE DATA - dBA SCALE

Date: March 6, 1974 Wind: 4.8 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m[1]				
Right to Left	74	72	72	73
Left to Right	74	72	72	73
Interior	81	79	82	81.5
Fresh Air Blr On	82	81	82.5	82.3

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 45-50 After Test 42-46

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 7.62m				
Right to Left	58.5	57.6	56	58.1
Left to Right	58	56	56	57
Interior	65	66.5	64	65.8
Fresh Air Blr On	71	69	70	70.5

Engine Idle, Vehicle at Rest

Ambient: Before Test 40-48 After Test 40-48

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	54 (70 Blr On)				54 (70 Blr On)				70
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	61.5	62	60.5	60.5	59.5	63	60	59.5	63

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(1)According to SAE J-986a.

(2)Average of the two highest readings that are within 2dB of each other.

TABLE I-4. PEUGEOT DIESEL CAR NOISE DATA - dBA SCALE

Date: March 26, 1974

Wind: 9.7 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test -

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m(1)				
Right to Left	70.5	71	70	70.8
Left to Right	70	70	70	70
Interior	76.5	78	79	78.5
Fresh Air Blr On	81	79	78	80

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 40-45 After Test -

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	61	61.5	60.5	61.3
Left to Right	59	60	60	60
Interior	67	65.5	66	66.5
Fresh Air Blr On	72	72.5	71	72.3

Engine Idle, Vehicle at Rest

Ambient: Before Test -- After Test --

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	52.5 (70 Blr On)				52 (70 Blr On)				70
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	68	58	64	64	66.5	58	64	63	68

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(1)According to SAE J-986a.

(2)Average of the two highest readings that are within 2dB of each other.

TABLE I-5. OPEL DIESEL CAR NOISE DATA - dBA SCALE

Date: March 26, 1974 Wind: 9.7 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m(1)				
Right to Left	67.5	67.5	67	67.5
Left to Right	67	67	67.5	67.3
Interior	73.5	74	72.5	73.8
Fresh Air Blr On	74	72.5	73	73.5

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	61	61.5	61.5	61.5
Left to Right	62.5	62.5	61	62.5
Interior	65	70	68	69
Fresh Air Blr On	70	71.5	70	70

Engine Idle, Vehicle at Rest

Ambient: Before Test 45-50 After Test 45-50

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	53.5 (70 Blr On)				53 (69.5 Blr On)				70
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	71.5	63	69.5	69.5	72	63.5	69	69	72

(1) According to SAE J-986a.

(2) Average of the two highest readings that are within 2dB of each other.

TABLE I -6. CAPRI PROCO DIESEL CAR NOISE DATA - dBA SCALE

Date: March 26, 1974 Wind: 9.7 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic
	1st	2nd	3rd	Average[2]
Exterior at 15.24m[1]				
Right to Left	75	75	75.5	75.3
Left to Right	76	76	76	76
Interior	83	82.5	83	83
Fresh Air Blr On	82	83	83	83

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic
	1st	2nd	3rd	Average[2]
Exterior at 15.24m				
Right to Left	58	58	59	58.5
Left to Right	57	57	57	57
Interior	71	69	70	70.5
Fresh Air Blr On	72.5	71	72	72.3

Engine Idle, Vehicle at Rest

Ambient: Before Test 40-45 After Test 40-45

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	66 (71 Blr On)				66 (71 Blr On)				71
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	63	55	60	61	63.5	55	61	61	63.5

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(1)According to SAE J-986a.

(2)Average of the two highest readings that are within 2dB of each other.

TABLE I-7. CAPRI DIESEL CAR NOISE DATA - dBA SCALE

Date: March 26, 1974 Wind: 9.7 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m(1)				
Right to Left	73	73.5	72	73.3
Left to Right	71.5	71.5	72	71.8
Interior	82	80	83	82.5
Fresh Air Blr On	83	82	83	83

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 40-45 After Test 40-45

	Pass			Arithmetic Average(2)
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	56	57	57.5	57.3
Left to Right	59	56	57	58
Interior	65	67	66	66.5
Fresh Air Blr On	71.5	72	71	71.8

Engine Idle, Vehicle at Rest

Ambient: Before Test 38-42 After Test 38-42

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	53 (70.5 Blr On)				53 (70 Blr On)				70.5
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	56	57.5	56	56	56	57.5	56	56	57.5

(1)According to SAE J-986a.

(2)Average of the two highest readings that are within 2dB of each other.

TABLE I-8. TEXACO TCCS CRICKET DIESEL CAR NOISE DATA - dBA SCALE

Date: August 13, 1974 Wind: 8.0 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 43-45 After Test 43-45

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m[1]				
Right to Left	67	67	66	67
Left to Right	67	66.5	66.5	66.8
Interior	76	75.5	76	76
Fresh Air Blr On	76	77	76.5	76.8

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 43-45 After Test 43-45

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	59	59.5	59.5	59.5
Left to Right	59.5	59	60.0	59.8
Interior	73.5	73	73	73.3
Fresh Air Blr On	72.5	75	73	74

Engine Idle, Vehicle at Rest

Ambient: Before Test 43-45 After Test 43-45

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	62.5 (66 Blr On)				62 (66 Blr On)				66
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	72	62.5	67	67	71	61	65	67	72

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[1] According to SAE J-986a.

[2] Average of the two highest readings that are within 2dB of each other.

Table I-9. TEXACO TCCS CRICKET GASOLINE CAR NOISE DATA - dBA SCALE

Date: August 13, 1974 Wind: 8.0 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 39-40 After Test 39-40

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m[1]				
Right to Left	67	66	66.5	66.8
Left to Right	65.5	66.5	67	66.8
Interior	75	74.5	75	75
Fresh Air Blr On	74.5	75	75	75

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 39-40 After Test 39-40

	Pass			Arithmetic Average[2]
	1st	2nd	3rd	
Exterior at 15.24m				
Right to Left	60	59.5	59.5	59.8
Left to Right	58	58.5	61	59.8
Interior	72	72	73	72.5
Fresh Air Blr On	73	71.5	72	72.5

Engine Idle, Vehicle at Rest

Ambient: Before Test 43-45 After Test 43-45

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	63 (66 Blr On)				65 (66.5 Blr On)				66.5
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	70	61.5	65.5	66	70.5	62.5	65	66	70.5

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[1] According to SAE J-986a.

[2] Average of the two highest readings that are within 2dB of each other.

TABLE I-10. HONDA CVCC CIVIC CAR NOISE DATA - dBA SCALE

Date: August 13, 1974 Wind: 4.8 km/hr SSE

Acceleration Test (2nd Gear)

Ambient: Before Test 46-47 After Test 46-47

	Pass			Arithmetic
	1st	2nd	3rd	Average[2]
Exterior at 15.24m[1]				
Right to Left	72	73	72	72.5
Left to Right	71	70	72	71.5
Interior	81.5	81	82	81.8
Fresh Air Blr On	81.5	82	82.5	82.3

Constant Speed 48.3 km/hr Driveby

Ambient: Before Test 43-44 After Test 43-44

	Pass			Arithmetic
	1st	2nd	3rd	Average[2]
Exterior at 15.24m				
Right to Left	56	56.5	56	56.3
Left to Right	57	56	56	56.5
Interior	73	75	75	75
Fresh Air Blr On	75	75	74	75

Engine Idle, Vehicle at Rest

Ambient: Before Test 45-48 After Test 45-48

	Test 1 - Direction A				Test 2 - Direction B				Max Reading
Interior	48 (73 Blr On)				49 (73.5 Blr On)				73.5
	Front	Rear	Left	Right	Front	Rear	Left	Right	
Exterior	58	55	53.5	53.5	58.5	56	54.5	53.5	58.5

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(1)According to SAE J-986a.
(2)Average of the two highest readings that are within 2dB of each other.